Proceedings of the

American Association of Textile Chemists and Colorists

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June 16, 1958

COUNCIL REPORT

210th Meeting • May 23, 1958 • Philadelphia, Pa.

OFFERING evidence that AATCC is doing a major job for the textile industry in providing the means for bringing together the talents and experience of many experts, President George O Linberg opened that 210th meeting of the Council by citing the fact that this was the 32nd in a series of AATCC meetings which had been held at Philadelphia's Hotel Sheraton over a three-day period. Twenty-five of the meetings were devoted to research and technical discussions, while the other seven dealt with administrative affairs.

Mr Linberg stated, "The development and exchange of technical information through research activities and the committee structure of AATCC is the reason for our existence and the proof of our success."

After expressing gratitude to the Delaware Valley Section for its invitation to the Council to meet in Philadelphia, President Linberg stressed the importance of the national body keeping in touch with the Sections through such meetings. He went on to point out how he has tried to bring such contacts about also by means of the "team presentation," namely, visits of the president, executive secretary, and research committee chairmen to various Sections. Charles W Dorn, chairman of the Executive Committee on Research, and Charles A Sylvester, chairman of the Technical Committee on Research, have discussed the research aspects of AATCC; George P Páine, executive secretary, has covered the functions of National Headquarters and its services to Sections; and Mr Linberg has sounded calls to action for an expanded membership (both individual and corporate), Section programs to interest young people in our industry, and an effort to make the public-at-large more textile conscious.

The "team" to date has spoken before meetings of the following Sections: Delaware Valley, Metropolitan, Washington, Mid-West, Hudson-Mohawk, Pacific Northwest, and Pacific Southwest. Future visits are scheduled at Rhode Island, Southeastern, and Niagara Frontier Section meetings.

In his remarks, Mr Linberg also pointed out that, as of May 1, AATCC had the largest number of individual members in its history. At April 30th, income from individual memberships for a nine-month's period was ahead of all last year.

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Reporting for the Appropriations Committee, Roland E Derby announced a recommended operating budget of $129,335 for the 1958-59 fiscal year. This decreased budget is predicated on substantial curtailment of activities in view of uncertain conditions in the industry. One principal economy effected will be the elimination of the office of assistant secretary at National Headquarters.

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Charles A Sylvester, chairman of the Technical Committee on Research, reported progress in test methods for "wash and wear," colorfastness to washing, antimicrobial finishes, mercerizing, and consumer end-use.

Complete details of the wash-wear appearance test method, covering seven different methods involving the washing and drying of fabrics as done in the home, will be published shortly in the *Proceedings*. The method has been submitted for letter ballot.

Tentative test method 87-58, Accelerated Test for Colorfastness to Industrial Laundering (cotton fibers) has been approved by TCR and will appear in the 1958 *Technical Manual*.

Methods for antimicrobial finishes, mercerizing, and consumer end-use have been submitted for letter ballot.

Mr Sylvester also announced the formation of an advisory committee on statistical methods, which will be headed by George Switlyk, E I du-Pont de Nemours & Co, Inc.

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ECR Chairman Dorn reported that TCR; John Siberston, Johnson & the following committee personnel changes: Nelson F Getchell, National Cotton Council to replace George S Buck Jr, National Cotton Council, on TCR; John Siberston, Johnson & Johnson, to replace P B Roth, American Cyanamid Co, as chairman of the Committee on Water Absorbency; Emil G Wiest, Du Pont, to replace P J Wood, Royce Chemical Co, as chairman of the Committee on Analytical Methods; M Joanne Spangler, Dan River Mills, to replace Charles L Zimmerman, Dan River Mills, on the Committee on Antibacterial Agents.

Joining the Committee on Nuclear Radiation are: O K Neville, Nuclear Chicago Corp; Francis M Sell, Deering Milliken Research Trust; and J C Arthur Jr, Southern Research Laboratories.

Joining the Committee on Colorfastness to Light are: Wilfred E Belanger and S H Lieb, Chrysler Corp; Edwin J Grajeck, Minnesota Mining & Mfg Co; L Ricard, Arnold, Hoffman & Co, Inc; and F T Simon, Union Carbide Chemicals Co.

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The National Headquarters Laboratories, under the direction of Harold W Stiegler, director of research, are chiefly active in work for four committees: Resistance to Abrasion, Colorfastness to Washing, Dimensional Changes in Textile Fibers, and Damage Caused by Retained Chlorine.

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ECR has approved the tentative program entitled "AATCC Research at Work" for the forthcoming Chicago Convention. This will take the form of a symposium under the sponsorship

of TCR. Fifteen Research Committees have indicated that they plan to exhibit at Chicago, while six more are weighing the possibility.

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Council favors, pending approval of the Appropriations Committee, a $1,000 grant to the American Standards Association for services in ISO (International Organization for Standardization) work.

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Vice presidents Weldon G Helmus, Ernest R Kaswell, and H Gillespie Smith reported briefly on activities within their respective regions. Mr Helmus commended the Delaware Valley Section for its Educational Committee's continuing service, announcing that its most recently sponsored course in "Colloids and Emulsions" had yielded a surplus of $350, which had been turned over to the Philadelphia Textile Institute. Mr Kaswell spoke of a proposed regional meeting of the New England Sections sometime next year. Mr Smith announced that a very successful membership drive in the South will result in two additional councilors from that region next year.

* * *

For the President's Advisory Committee, J Robert Bonnar reported that a proposal for an Executive Committee of the Council will be submitted to Council in Charlotte, NC, on Sept 19. Upon the recommendation of PAC, Council approved the appointment of a committee to study the possibilities of a merit award for service to the Association. Such an award would be for service outside the areas covered by the Olney Medal and Honorary Membership.

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Weldon G Helmus, reporting for the Membership and Local Sections Committee, suggested a method by which the processing of membership applications could be streamlined. Council granted the Committee power to elect all classes of membership pending a change in the bylaws to cover the procedure.

* * *

Roland E Derby was nominated and approved by Council to succeed Albert E Sampson as chairman of the Colour Index Marketing Committee, following Mr Sampson's resignation from the chairmanship for reason of ill health. Also named to the Committee were Miles A Dahlen, E I du-Pont de Nemours & Co, Inc; A Henry Gaede, Laurel Soap Mfg Co; and Charles A Whitehead, Howes Publishing Co, Inc.

Mr Derby reported that Volume 4 of the *Colour Index* would be delivered to subscribers this fall.

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For the Publications Committee, Walter M Scott reported that William H Cady had expressed a desire to be relieved of his duties as editor of the *AATCC Technical Manual*, chairman of the *Colour Index* Editing Committee and coordinator of the *Colour Index*.

Whereupon William A Holst read the following resolution:—

"Whereas William H Cady has expressed his desire to be relieved of his duties as editor of the *Technical Manual and Year Book of the American Association of Textile Chemists and Colorists*, and as coordinator of the *Colour Index*, the Publications Committee, while regretfully recommending to the Council that his wishes be heeded and his resignation from these positions accepted, unanimously pays tribute to his faithful, arduous and distinguished performance of those duties over many years, and further recommends similar recognition by the Council."

Council approved the resolution unanimously and gave a rising vote of thanks to Mr Cady.

The nomination of William D Appel to assume Mr Cady's duties when he sees fit to relinquish them was approved. Council also approved the appointment of Carl Z Draves to the Publications Committee.

By Council action, the name of the *AATCC Technical Manual and Year Book* will be shortened to "AATCC Technical Manual," effective with the 1958 issue.

* * *

Elliott Morrill, vice president (Western Region), chairman of the 1958 Convention, reported briefly on plans for the event, which will be held in Chicago, Oct 30-Nov 1. He noted that the technical program is almost complete, and also mentioned the TCR-sponsored exhibits and symposium, ladies program and special events.

Ernest R Kaswell, vice president (New England Region), chairman of the 1957 Convention, presented a check for $9,652.40, representing surplus from the Boston meeting, to the treasurer.

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Council approved a tentative plan to hold the 1962 Convention in the Southern Region, probably at Atlanta, Ga.

* * *

Paul J Luck, Ciba Co, Inc, was approved as chairman of the Publicity Committee. George P Paine had been serving as chairman *pro tem* following the resignation of James A Doyle as chairman early this year.

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Upon the recommendation of Sidney M Edelstein, chairman of the Archives Committee, Council approved the nomination of Arthur R Thompson, Ciba Co Inc, to the Committee.

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Executive secretary Paine read a communication from the newly formed Argentine Association of Textile Chemists and Colorists, inviting American visitors to be guests of the Argentine association at its meetings.

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The next meeting of the Council will be held September 19, 1958 in Charlotte, NC, at the invitation of the Piedmont Section.

PAPERS ON DYEING AND FINISHING WANTED

ALTHOUGH the technical program for the 1958 AATCC Convention is nearing completion, there are still some openings in the program for papers dealing with dyeing and finishing.

Individuals and/or firms desiring to present such papers at the Convention in Chicago, Oct 30-Nov 1, should send 100-200 word summaries to: Leonard J Armstrong, Varney Chemical Corp, Janesville, Wisconsin.

Oral presentation should be streamlined to a 20-minute delivery time.

36th Annual Convention———

ELIMINATION OF STATIC ELECTRICITY FROM TEXTILES BY CHEMICAL FINISHING*

E I VALKO[1], G C TESORO[2], and W GINILEWICZ
Onyx Oil & Chemical Co
Jersey City 2, NJ

The mechanism of protection against static accumulation is described in terms of chemical structure of finishes and processing aids. Electrical conductance of antistatic agents is related to their capacity to ionize and to attract water. The dependence of the electrical resistance of the finished textiles on the construction of the fabric and on the nature of the fiber is illustrated.

An economical multi-purpose finishing treatment based on the combination of antistatic protection with pigment padding is described.

INTRODUCTION

IT has been shown that the only chemical mechanism by which accumulation of electrical charges by textiles can be prevented effectively is by increasing the electrical conductivity (or reducing the resistivity) of the textile (*1, 2, 3, 4, 5*). Therefore, the chemical protection of hydrophobic fibers against static must be based on a finish which increases the conductance of the fibers, or their assemblies, to a level comparable to that shown by hydrophilic fibers, such as cotton and rayon. This is true for fugitive antistatic processing aids as well as for durable finishes which must withstand wear, washing and drycleaning for the useful life of the garment or industrial fabric. Thus, the mechanism of antistatic protecton and the required level of efficiency are fundamentally the same for fugitive antistatic agents and durable finishes. The difference between them lies in their physico-chemical properties, which determine their response to repeated treatments with soap and detergent solutions and drycleaning fluids.

Disregarding the use of carbon black as an electrically conducting pigment in some special cases (*6*), a textile fiber (other than metal) must contain water in order to be static-free. Even natural hydrophilic fibers become insulators, and therefore prone to accumulate electrostatic charges, when they are bone dry. The reason for this unique role of water is that, aside from metallic conductance, only electrolytic conductance can provide the necessary property to textiles. Electrolytic conductance requires the presence of a medium of high dielectric constant, and water is the only medium in this class which is replenished from the atmosphere when lost. In the case of fugitive antistatic agents, organic solvents of high dielectric constant could conceivably replace water, but they would be readily removed by evaporation or solution and thus be entirely unsuitable in the case of durable finishes.

It is obvious that, in order to secure the presence of water in or on the fiber, a hygroscopic compound must be associated with the fiber. With natural fibers, these hygroscopic compounds are an integral part of the fiber substance. For example, in cotton or rayon, the amorphous portion of the cellulose acts as such hygroscopic compound. If the synthetics do not contain sufficient hygroscopic components, antistatic protection requires the addition of such compounds in the form of a finish. In both cases, hygroscopic fiber substance and hygroscopic finish, the efficiency of antistatic protection will depend on the following variables:

1) amount of moisture regain,
2) microscopic and macroscopic distribution of the hygroscopic body,
3) presence of ions and their mobility in the hygroscopic body.

Quantitative knowledge of the relation between efficiency of antistatic protection (measured as lowering of the electrical resistivity of the fabric) and these variables is scanty. The purpose of this paper is to contribute toward the knowledge of these relationships. In addition, this paper outlines a method for the quantitative determination of cross-linked polyamines applied to fabrics as antistatic finishes and describes their behavior as pigment binders.

HYGROSCOPICITY

The relation between amount of moisture regain and resistivity has been investigated in a quantitative manner for most of the natural fibers, and exhaustively for cotton. Most of the observations show proportionality between the log of moisture regain and the log of the resistivity (*7*).

In most cases, for any one fiber, the doubling of the moisture regain reduces the log R by three or four units, ie, the resistivity by a factor of 1000 to 10,000. The same amount of moisture does not necessarily result in the same resistivity for various fibers even though it is true that, at constant relative humidity, the fibers with higher moisture regain generally show lower resistivity. Wool has a higher moisture regain than cotton but at the same time a higher resistivity. This might be due to a non-uniform distribution of the moisture. If the cuticle cells of the fiber are less hygroscopic than the cortex, a lower efficiency of the absorbed moisture results. In the case of wool, the second factor, distribution of the moisture, overshadows the first factor, amount of moisture.

Most, if not all of the presently used nondurable antistatic processing aids appear to be surface-active agents. A large number of them are quaternary ammonium or polyoxyethylated compounds. Both the quaternary groups and the polyethoxy group are known to be hygroscopic. Only a few experimental data were published to allow a quantitative correlation between their hygroscopicity and antistatic efficiency (*8*). Even less is known in this respect of the few durable antistatic finishes.

U S Patent No 2,767,107 (*9*) describes an antistatic finish produced by the polymerization of polyethylene glycol diacrylate on the fiber. Such a product will, no doubt, exhibit high hygroscopicity due to the presence of the polyoxyethyl chain.

The durable antistatic finishes Aston LT[3] and Aston 108[3] contain polyoxyethyl chains as well as ionic

* Presented by G C Tesoro on November 16, 1957 during the 36th Annual AATTC Convention at the Hotel Statler, Boston, Mass.

[1] Present address: Lowell Technological Institute, Lowell, Mass.

[2] Present address: Central Research Laboratory, J P Stevens & Co, Garfield, NJ.

[3] Registered trade marks.

groups. Both of these contribute to the hygroscopicity of the resin. These finishes were described in a previous publication *(4)*. They are applied to the textile from aqueous solution in the form of soluble polymers containing reactive groups, together with soluble multifunctional cross-linking agents. The reaction between these components is carried out on the textile material at elevated temperature. The cured finish forms an ion exchange resin on the surface of the fiber.

In order to determine the moisture regain of one of these finishes, Aston 108, it was applied in a rather high concentration to a Dacron fabric. After the amount of resin left on the fabric after drying, curing and rinsing was determined, the fabric was exposed to air of various relative humidities, which were established by equilibrating the air with saturated aqueous solutions of suitably selected salts. The amount of moisture taken up by the fabric itself could be neglected and, therefore, the weight change gave the moisture take-up of the finish. It was determined in both directions: first, in the direction of increasing humidity starting from the dry state and then in the direction of decreasing humidity starting from the equilibrium with 96% rel humidity. Figure 1 shows the results and indicates that the hysteresis was small. The general shape of the curves conforms with the sigmoid form usually observed with polymeric materials, although the initial rapid rise to occur between 0 and 30% relative humidity is verified only by way of extrapolation.

At 60% relative humidity, the moisture regain of both finishes was found to be 22 ± 5%. This is a value some two to three times higher than the moisture regain of cellulose in the form of cotton or rayon. Since, as was stated before, the doubling of moisture regain reduces the log R by three or four units (the resistivity by a factor of 1000 to 10,000) this high level of hygroscopicity is of great significance for the level of antistatic efficiency observed with the finishes.

Since every ionizing group is hygroscopic, durable antistatic finishes can be prepared without the presence of nonionic hygroscopic groups in the molecule, just as in the case of nondurable antistatic compounds. Resins of the Aston type not containing polyoxyethylene chains were found to show efficiency and durability of the same order as Aston.

If all other variables were kept constant, increased hygroscopicity

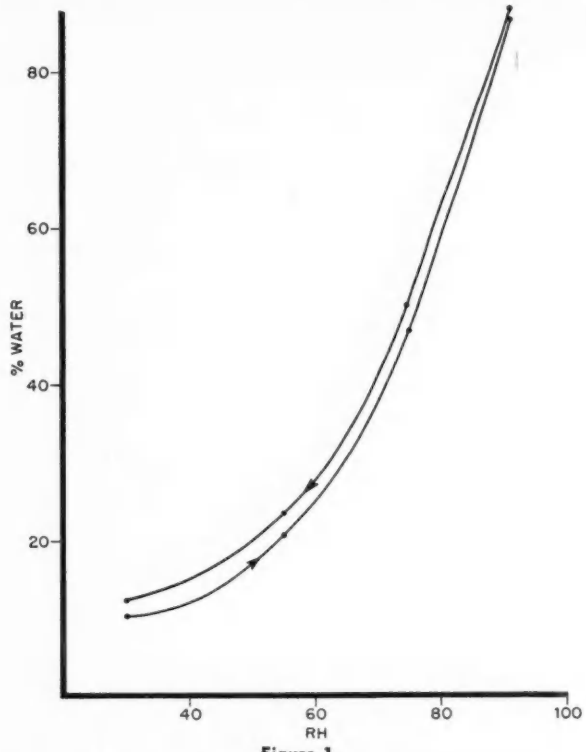


Figure 1
Water absorption of an antistatic finish (Aston 108) as a function of the relative humidity at 20°C. Absorption and desorption.

should result in a more efficient antistatic agent. With durable antistatic finishes however, the hygroscopicity, while increasing the efficiency, will tend to reduce durability, since it causes high swelling of the finish in the aqueous washing solution. The swollen finish shows a reduced mechanical strength, and consequently a reduced resistance to wet abrasion, which appears to be the most important factor in the removal of the finish during laundering. The ideal durable antistatic finish should thus combine the highest possible moisture regain at medium and low relative humidities with the lowest possible swelling in water. If the durable finish is fixed on the fiber by cross-linking of polymer molecules, as is the case with the Astons, the extent of swelling is controlled in principle by the degree of cross-linking (as determined by the average distance of cross-linkable groups and the ratio of these groups actually cross-linked). In our experiments, we found that, for any given system, a higher degree of cross-linking increased the number of launderings the fabric could withstand without losing the antistatic protection.

It was interesting to compare the dependence of the resistivity on relative humidity for the Aston-finished fabric with the behavior of cotton. Swatches of a Dacron fabric were treated with various amounts of Aston LT and cured. They were brought into equilibrium first at 30, then 60, and finally 90% RH and tested. Subsequently, the same swatches were brought into equilibrium at 60, and finally again 30% RH in order to establish hysteresis. In order to ascertain that no appreciable irreversible change occurred during the cycle, the swatches were brought back again to 60% RH and the values so obtained compared with those obtained on the first leg of the cycle. The whole procedure was repeated with swatches which were thoroughly rinsed with distilled water to remove electrolytes and other impurities of the original treatment. The results are shown graphically in Figure 2. Similar experiments were carried out with Aston 108 and, for comparison, with bleached and rinsed cotton fabric (Figure 3). The results show that there is no fundamental difference in the behavior of cotton and Aston-finished Dacron fabric. They also show that rinsing of the antistatic-finished fabrics increases their resistivity, due to the removal of electrolytic impuri-

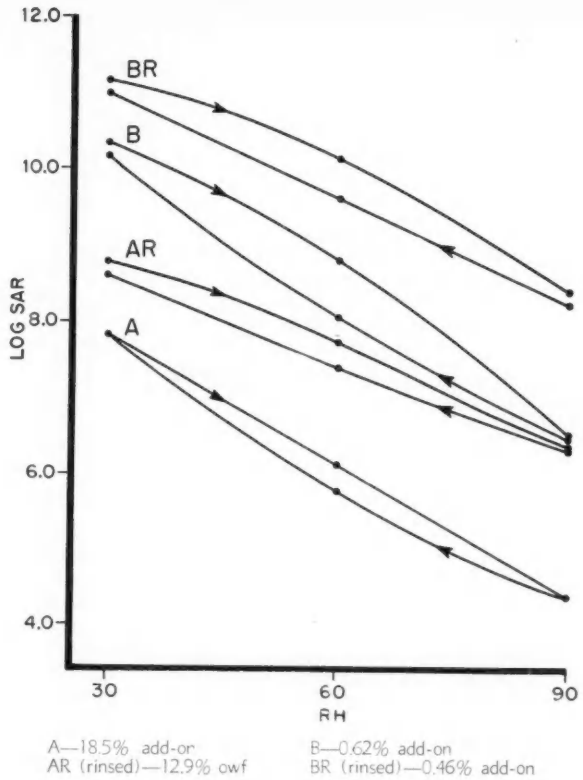


Figure 2
Specific area resistivity of a Dacron fabric treated with an antistatic finish (Aston LT) as a function of the relative humidity. Absorption and desorption.

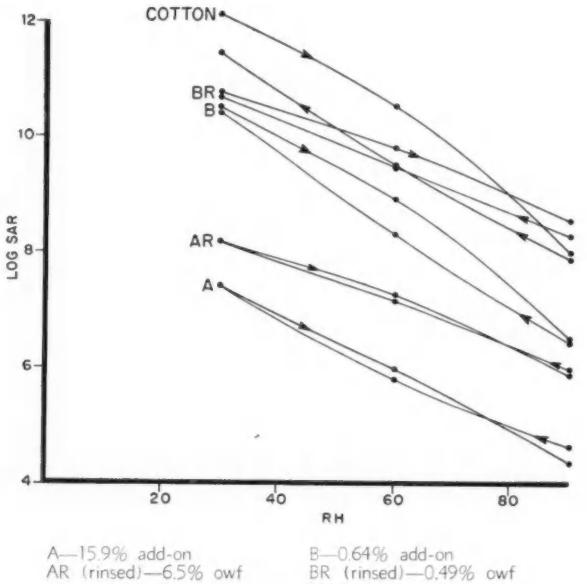


Figure 3
Specific area resistivity of a Dacron fabric treated with an antistatic finish (Aston 108) compared with the behavior of cotton as a function of the relative humidity. Absorption and desorption.

ties and of the unfixed portion of the finish. The slope for the unrinsed fabrics is steeper than for the rinsed fabrics. This is probably due to the decreased efficiency of those electrolytic impurities which have insufficient solubility at low humidities.

The slope for the rinsed fabrics is less steep than the one for cotton; in other words, the finish appears to be somewhat less sensitive to humidity changes than does cotton. Strangely, the hysteresis appears larger with lower amounts of resin.

The graphs show that an increase of the amount of resin by a factor of 10 to 20 reduces the resistivity by a factor of 100 to 1000.

Comparison of the curves shows that, at 30% RH, Dacron finished to retain approximately 0.5% of either of the Astons after rinsing has a conductivity about ten times as high as that of cotton. At higher humidity the two fibers show the same resistivity because of the difference in the slope. From the standpoint of antistatic protection, the behavior at low humidities is more important.

The moisture regain of Aston at 30% RH is about 10% so that the finished and rinsed fiber contains only 0.05% water against some 5% moisture regain for cotton at the same humidity. Still, the former is more conductant than the latter. This can be ascribed to the greater continuity of the aqueous path and higher ionic concentration in the antistatic finish.

IONIZATION AND IONIC MOBILITY

The importance of the presence of ions was mentioned in general terms. If all other factors are constant, the conductance of the textile should be roughly proportional to the equivalent concentration of electrolytes present. This, in turn, depends on the amount and electrolyte concentration in the solution applied to the fabric.

A few words are in order to explain the units used in expressing the electrical resistivity of fabrics and the relation of these values to the conductance values obtained in electrolytic measurements.

The specific area resistivity (SAR) of a fabric is defined as the resistivity between parallel electrodes touching the fabric surface in a distance equal to their width. Thus, the SAR value is characteristic for the fabric and does not depend on the actual size of the electrodes as long as the fabric is sufficiently uniform in its electrical properties. Fabric construction and other shape factors influence SAR, but the weight of the fabric itself can be

taken into account when defining the mass resistivity as SAR divided by the weight of the fabric by unit area (grams per square cm). The measurements of SAR reported here were made on fabrics of three to six ounces per yard weight.

Cotton fabric of such weight shows a SAR of approximately 12 ohms, ie, log SAR = 12 at 30% RH. Polyester fabrics have a log SAR of about 16. If we agree that cotton possesses a minimum level of protection against static accumulation, then, in order to bring the SAR of polyester fabric to the level of cotton, its electrical resistivity must be reduced by a ratio of ten thousand.

Among the antistatic processing aids are many nonionic surfactants. A nonionic compound does not contribute to the conductance of aqueous solutions. The question arises as to how it increases the conductance of a textile fabric. Usually, a fabric contains electrolytes as impurities and the nonionic compound serves only as a hygroscopic agent providing a vehicle for the ions present on the fabric. The significance of the tramp electrolytes for the resistivity of the fabrics can be illustrated by the following example.

A distilled or de-ionized water, prepared and kept without special precautions, has a specific conductivity of 10^{-6} mhos per cm (or a log R of 6). The contribution of this kind of water, if retained on the fabric in an amount of about 20% on weight of the fabric after rinsing, would reduce the log SAR of the Dacron fabric from 16 to a value of 8 or 9. (This is the resistivity of this amount of water when it forms a continuous film between the electrodes.)

Obviously, even this water of comparatively high purity, when used as a rinse water, could supply sufficient amount of ions to reduce the resistivity of the polyester fabric not only to the level of cotton but even a thousand times lower if the ions retained their full mobility. As the fabric is dried and the amount of water present drops to that corresponding to the equilibrium with the atmosphere, the continuity of the water film is lost and the resistivity increases to the observed value of 14-16.

The electrolytes, however, contribute to the conductance of the system only if they are dissolved. A compound remains dissolved only if the relative humidity of the atmosphere with which it is in equilibrium is higher than the vapor pressure of the saturated solution of the compound. The influence of electrolytes on the resistivity of the fibers should therefore more or less rapidly decrease as the relative humidity drops. Only a small fraction of the salts commonly dissolved in tap water will remain in solution at 30% RH. Furthermore, the surface tension of the solutions might cause the solution of electrolytes to form discreet droplets, instead of continuous layers on the surface of the fibers, thus reducing their efficiency as electrical conductors. These relations were investigated by the following experiments.

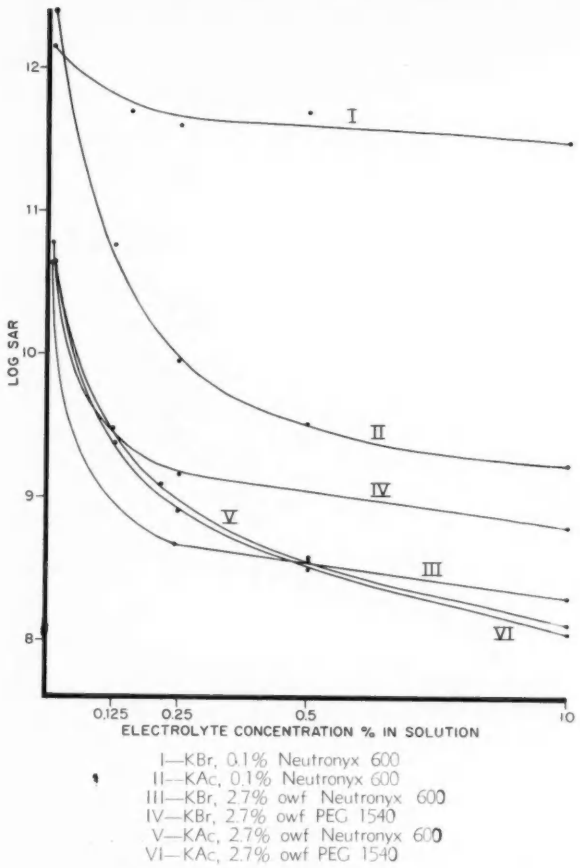
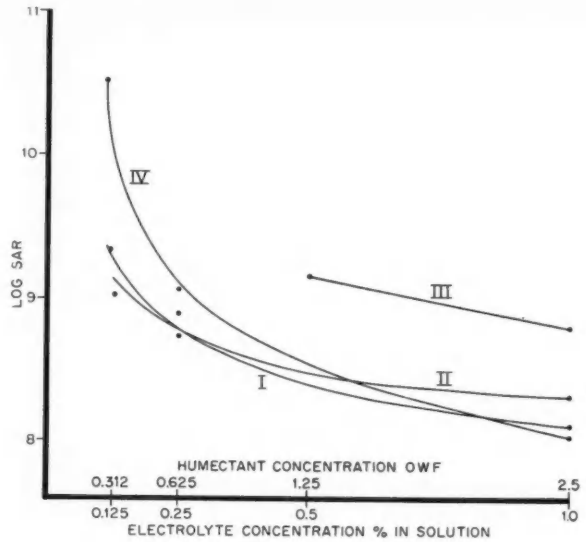


Figure 4
Specific area resistivity at 30% RH of a Dacron fabric treated with electrolyte solutions of varying concentrations with and without the presence of humectants.

Two electrolytes ——— potassium bromide, which is not deliquescent at 30% RH, and potassium acetate, which is deliquescent at this humidity ———were applied from aqueous solution to a scoured Dacron fabric rinsed with distilled water. The Dacron fabric itself has shown in our measurement a log SAR value higher than 14. The literature data indicates the probable value in the 16-18 region, but our instrument did not allow the measurement of a resistivity higher than 10^{14} Ohms.

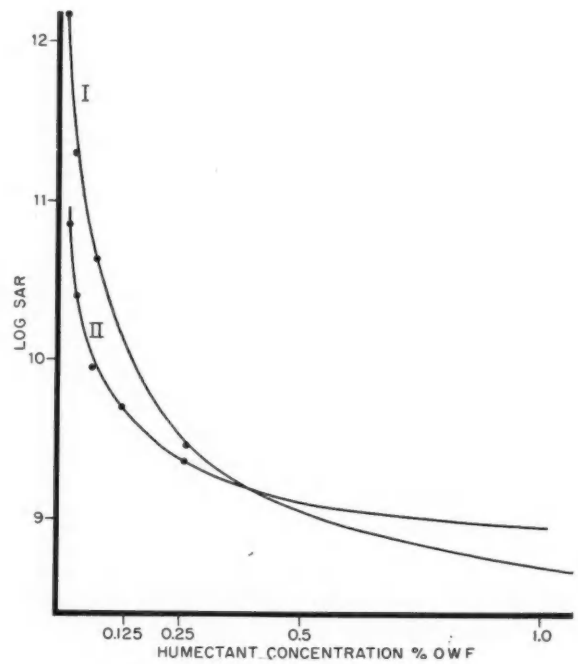
Treatment of the fabric with a 0.5% solution of the bromide still gave a resistance value above the sensitivity of the instrument at 30% RH, but with 0.5% acetate a log SAR value of 12.3 was obtained. To eliminate the possibility of uneven wetting and lack of penetration as the cause for the comparative inefficiency of the salt solution, a 0.1% solution of a nonionic wetting agent, Neutronyx 600, was added to the solution. With this addition, lower values of resistivity well within the range of the instrument were obtained with both electrolytes. The solution of Neutronyx 600 in distilled water showed very low conductance. Since the wet pick-up of the fabric was approximately 20%, it provided about 0.02% add on to the fabric. The fabric, after applying the penetrant alone, gave a log SAR of 12.5, instead of the original value of over 14.

Figure 4 shows the log SAR values obtained with various concentrations



I—KAc, Neutronyx 600
II—KBr, Neutronyx 600
III—KBr, PEG 1540
V—KAc, PEG 1540

Figure 5
Specific area resistivity at 30% RH of a Dacron fabric treated with solutions containing varying concentrations of humectants and electrolytes. Ratio of humectant to electrolytic maintained constant.



I—Neutronyx 600 and 0.5% KBr in solution
II—PEG 1540 and 0.5% KBr in solution

Figure 6
Effect of varying amounts of humectants on the specific area resistivity of a Dacron fabric at 30% RH at constant electrolyte concentration.

of the two electrolytes in presence of the penetrant. Potassium bromide, even in high concentrations, remains very inefficient in reducing the resistivity (I), whereas, the effect of potassium acetate (II) increases with increasing concentration. The fact that the contribution of the acetate to the conductivity of the fabric is only 1/100,000 of what it would be if the salt had maintained its solution conductance indicates that, even with the penetrant, the concentrated salt solution does not cover the fibers in the form of a continuous film.

A further reduction of the resistivity was obtained if substantial quantities of hygroscopic agents were applied instead of the small amount of penetrant. Curve III shows the results with KBr in presence of 2.7% Neutronyx 600 (now functioning as a humectant), and Curve IV, in presence of the same amount of polyethylene glycol 1540. Curve V represents the data obtained with potassium acetate in presence of 2.7% Neutronyx 600, and Curve VI, in presence of the same amount of polyethylene glycol 1540.

It is clear that the presence of a humectant on the fiber increases the effect of the electrolytes on the resistance considerably. This is not only true for the deliquescent potassium acetate but also for KBr, which is not expected to dissolve at 30% RH. It must be assumed that the salt does dissolve, to a certain extent, in the humectant or humectant-water mixture.

This appears to be in agreement with observations by O'Sullivan, Murphy and Walker (*10, 11*) and others, on the effect of salt content on the resistivity of cotton and regenerated cellulose. Complex formation between the salt and the nonionic penetrant, probably involving the ether oxygens of the penetrant molecules might explain this solubility. Similar complexes might form between the oxygen atoms of the cellulose and salt molecules in the cellulosic fibers.

Figure 5 shows the effect of the concentration of the treating solution on the log SAR value of the treated fabric when the ratio of humectant to salt is kept constant. The sharp upturn of the curves at the extreme left indicates that in this region the amount of humectant becomes insufficient to activate the salt. This can be even more convincingly demonstrated by adding increasing amounts of humectant to a constant concentration of potassium bromide (Figure 6).

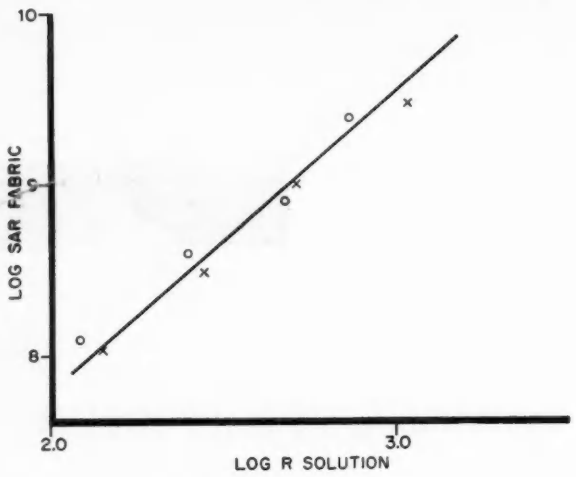


Figure 7
Specific area resistivity at 30% RH of a Dacron fabric as a function of the specific resistivity of the treating solution in presence of humectants.

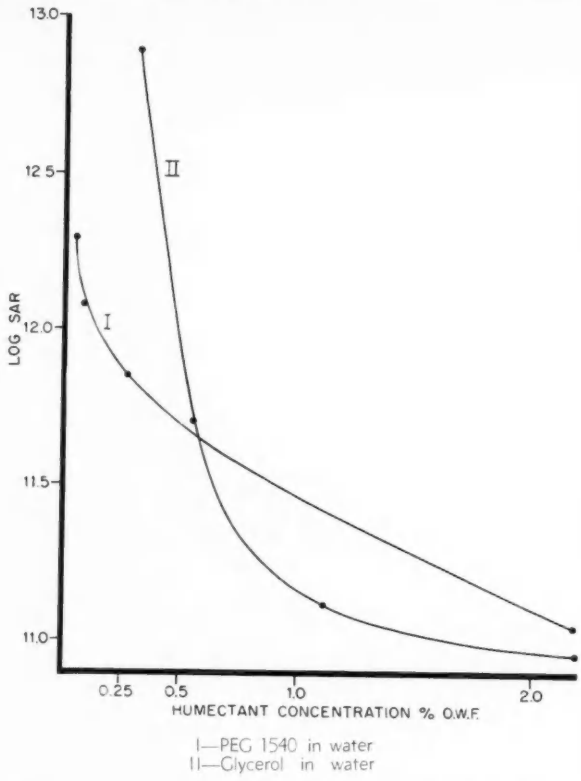


Figure 8
Effect of humectant on specific resistivity of a Dacron fabric at 30% RH. No electrolytes added.

In presence of a sufficiently high constant level of humectant, a close relation should exist between the conductance of the treating solution and that of the treated fabric. This is shown in Figure 7, where the log of the specific (volume) resistivity of the solution is plotted against log SAR of the fabric.

In view of these observations, the pronounced effect of glycerol and PEG 1540 (without addition of electrolytes) on the resistivity (as shown in Figure 8) must be interpreted as increased mobilization of tramp electrolytes present on the fabric, or introduced with the hygroscopic agent. [See also Ward (8)].

The foregoing experiments teach that hygroscopic agents alone are capable of providing a certain amount of antistatic protection whenever tramp electrolytes are present. Their efficiency, however, increases considerably with increasing amount of electrolyte present. Therefore, ionizing antistatic agents are, in general, more efficient than mere hygroscopic agent. Relying on tramp electrolytes alone, the efficiency of the antistatic finish would depend on the purity or rather, on the impurities of the last rinse water. For optimum and consistent efficiency, the antistatic finish must supply its own electrolyte. Only a finish composed of an ion-exchange resin of suitable structure can establish its efficiency level independently of the nature of the rinse water.

With an equivalent weight of about 1000 for Aston, a 5% solution which can supply 1% finish owf contains approximately the same equivalent concentration of "built-in" electrolyte as a 0.5% solution of potassium acetate. It is therefore not surprising that similar log SAR values are obtained by treating the fabric with solutions containing 0.5% potassium acetate +5% humectant (1% humectant owf) or 5% Aston (1% Aston owf).

It was mentioned before that the application to Dacron of a 0.1% solution of penetrant (Neutronyx 600) representing less than 0.02% on the weight of fabric is sufficient to reduce the log of the resistivity of the fabric to 12.5. Experiments represented in Figure 5 show that as little as 0.015% owf Neutronyx 600 reduced the log SAR in presence of 0.5% KBr to 12.2. Polyethylene glycol 1540 in the same amount gave a value of 10.8. (Potassium bromide in 0.5% solution without any humectant and penetrant gave a log SAR value higher than 14.) The amounts of humectant which were found effective are of the same order as the amounts needed for the monomolecular coating of the individual filaments. It is hard to imagine that such a thin coating would be continuous enough to account for the reduction of resistivity observed. We must rather assume that wider channels of conducting layers form around the yarn or along other preferred paths.

DETERMINATION OF THE AMOUNT OF ANTISTATIC FINISH BY DYE ABSORPTION

In order to investigate the correlation between chemical structure and performance of an antistatic finish, it is necessary to ascertain the quantity of finish on the fabric. If the finish is not substantive, ie, preferentially adsorbed from the bath, or if the rate of application does not allow the preferential adsorption to occur to any appreciable extent, the amount of treating liquid remaining on the fabric to be dried on gives a satisfactory measure of the finish initially on the fabric. If these conditions are not fulfilled or if an unknown part of the finish is removed, as by washing or rinsing a durable finish, a method is needed to determine the amount of finish actually present. Weight differences can be determined accurately only in the case of relatively large amounts of add-on.

the case of Aston, the ion-exchange capacity of the resin provides an accurate measure of the amount of finish present on a fabric. The ion-exchange capacity can be conveniently determined by using anionic dyes as exchange ions. The ion-exchange reaction is carried out in presence of an acid, such as acetic acid, in order to activate the amino groups of the finish to full capacity, and the amount of dye absorbed by the resin can be determined either by stripping the dye from the treated fabric, or preferably, by measuring the amount of dye exhausted onto the treated fabric from a solution containing a moderate excess of dye (approximately 200% of amount absorbed). In either case fast and sensitive colorimetric measurements are used with excellent results. The necessary calibration experiment can be carried out for each resin either with a known amount of finish (determined by weight difference as add-on) or by using a sample of unsupported resin representing the finishing compound. Calibration experiments carried out by these two techniques gave results which were in good agreement with each other. The adsorption equilibrium on the fabric was reached in a time varying between five minutes and several hours. Generally, there was a strong tendency to reach equilibrium in a shorter time when the distance of the cross-linking groups was greater. For instance, when some eight atoms separated the cross-links, only 80% of the equilibrium value was reached in one hour; whereas, when a distance of some 100 atoms, equilibrium was reached in less than five minutes. A very close correlation was found between the number of basic groups and the amount of dye absorbed. At equilibrium, one molecule of the monosulfonic dye was absorbed by each basic group, regardless whether the distance between the basic groups were eight or 100 atoms.

Treatment with anionic detergents reduced the absorption capacity of Aston 108 for anionic dyes but did not affect that of Aston LT.

PIGMENT PADDING WITH ANTISTATIC FINISH

Since the Aston durable antistatic finish forms an insoluble resin on the fibers, it was interesting to investigate its possible use as a binder for pigments. Such a use would combine pigment dyeing and antistatic finishing in one operation, with ensuing saving of chemicals, labor and equipment.

It was found that Aston, when mixed with suitable pigments, is capable of giving uniform dyeings on fabrics woven from hydrophobic fibers. The durability of the dyeings does not reach the level attained by conventional dyeing methods but is probably satisfactory for many purposes.

The fact that the durability of Aston as a pigment binder appears to be at a lower level than its durability as an antistatic finish is the consequence of the different yardsticks applied: in the former case, the visual evaluation of the aesthetic properties; in the latter, the functional evaluation of the electrical performance. With an efficient antistatic finish, even removing a large portion of the amount originally applied leaves sufficient protection. Color, on the other hand, is considered satisfactory only as long as it is not appreciably changed, regardless of its original level. Removal of 10% of the color represents "failure" because it is noticed as "fading."

In comparing Aston with a commercial pigment binder, it was observed that on hydrophobic fibers, such as nylon and Dacron, Aston gave a much better color yield; whereas, on cotton and rayon the commercial product gave a somewhat fuller shade.

It was thought that possibly a difference in the tendency of the pigment particles (Phthalocyanine Blue) to aggregation, depending on the fiber and the binder, might be responsible for this behavior. Therefore, instead of a pigment, a soluble dye, Acid Orange 7 (*CI* 15510) was used to color the binder. Surprisingly, the same behavior was observed. To ascertain that no actual difference in the amount of dye on the different textile materials existed, the dye was stripped from the fabric. It was found that, even when the same amount of the acid dye was present with the two different binders, the commercial binder gave the higher color value on cotton, and Aston gave a higher value on Dacron. Whatever the cause of this phenomenon, it was obvious that, aside from durability, the color yield is an important function of the binder used.

On the hydrophobic textiles, Aston provided a binder more durable than commercial binders. On cotton, the reverse was observed.

Another possibility is to apply the commercial binder system together with Aston. It was found that the compatibility of these systems allowed such a combination of operations.

An attempt to apply the AATCC's accelerated wash test method to the pigment-dyed fabric gave rise to an interesting observation. In contrast to the effect of regular Launder-ometer tests and to the effect of repeated washings with the Westinghouse household machine, both of which showed uniform removal of the pigment, the accelerated test gave fabrics with obviously mottled appearance. Apparently, the brutal beating of the steel balls leads to spotwise removal of the pigmented resin layer. This behavior was observed with Aston and commercial binders alike, and might seriously impair the validity of the accelerated test method for surface resins in general.

SUMMARY

The efficiency of both types of antistatic agents, fugitive processing aids and durable finishes is due to their contribution to the electrical conductivity of the textile. This in turn depends on the amount of moisture held by the agent, and its microscopic and microscopic distribution, and on the presence of ions and their mobility. The significance of these factors is demonstrated by showing that nonionic humectants activate the electrolytes present on the textiles and by the example of an ion-exchange type of resin developed for durable antistatic protection. Such a resin finish embodies the synergistic hygroscopic and electrolytic factors in one compound.

A quantitative method for the determination of certain types of durable antistatic finish on the fabric has been described.

A finish with dual function can be applied by using the durable antistatic compounds as pigment binders.

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36th Annual Convention———

NUCLEAR ENERGY—A NEW TOOL FOR THE TEXTILE INDUSTRY*

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It has become popular during the last several years to speculate concerning the part that atomic energy might play in the future of various industries, particularly when such energy in large quantities is available at reasonable cost. The experimental application of atomic energy has been fruitful in several industries, notably in food preservation, but as yet nothing of any great interest has developed in the field of textiles.

The development of new products for the textile industry through radiation chemistry, at least in the near future, appears unlikely. However, it is not impossible that polymerization reactions initiated by high-energy radiation may some day produce fiber-forming materials of unusual interest. The application of radiochemical techniques as a means of studying or solving problems peculiar to the textile industry appears to be of the most immediate interest. Such techniques might apply to plant process control, analytical problems, and to problems where tracers might be used. Several examples of these applications are given.

INTRODUCTION

It is possible to predict, without the aid of a crystall ball, that nuclear technology will find at least a few applications in the textile industry and the industries closely allied with it. The fundamental nature of the problems in the textile industry is not very different from that in other industries but, generally speaking, we tend to lag behind somewhat in the application of newly developed techniques to help us with our problems, and to think of these techniques as a means of making better products. The literature is well documented with ideas concerning the application of nuclear technology in other fields (*1*); for example, the oil industry long ago realized the potentials of atomic energy and has initiated research programs to explore thoroughly the long-range implications of nuclear technology developments. Let us hope that our industry will embark upon a similar program, and through research determine the uses that we might make of this new tool, nuclear energy.

DISCUSSION

The field of nuclear technology may be broadly classified into three areas as far as uses are concerned, namely, power, radiation, and radioactive isotopes. The use of the atom as a source of energy to make power is by this time an old story and is indeed very practical. Other industries have used radioactive isotopes to advantage as tracers and in gauges of various types. The application of radiation, however, is still largely in the research area and the practical phases of this aspect of nuclear technology, it is safe to say, are still largely unexplored. Other industries, as already stated, have recognized the possibilities of the creation of new and better products through the medium of radiation chemistry and they have looked forward to its practical application at such time when various types of radiation are available in quantity and at low cost. Economic supplies of radiation will arise from at least two sources: as a byproduct of power reactors, and from reactors made for the production of radiation alone. Moreover, new and powerful sources of high-energy radiation, such as van de Graaff machines, which are of relatively low cost, efficient, and practical for industrial applications, are becoming increasingly available. The rubber industry, the petroleum industry, and those industries interested in food preservation, to mention a few, have recognized the possibilities in this area and are actively engaged in research for the purpose of creating new and better products.

Physicists now recognize a number of different nuclear particles. A few of these are protons, neutrons, mesons, electrons, positrons, alpha particles, and neutrinos. Two of them, the proton and neutron, are the particles from which the nuclei of all atoms are built. The other particles are known or are believed to result in various changes which the nucleus can undergo. In a stable element, the mass of protons and neutrons present in the nucleus constitute a happy family and the element displays no signs of radioactivity. If, however, by some means an extra neutron or two is shot into the nucleus, an unbalanced situation may occur and the element will then give off particles of various sorts, and sometimes very powerful electromagnetic waves, such as gamma rays. This process of liberation of radiation may take place continuously over short periods or over long periods of time until finally enough particles have been given off so that the nucleus again reaches a stable state and the element is no longer radioactive. For example, if sodium is placed in a neutron source, a radioactive isotope, sodium-24, may be produced. This isotope, the half-life of which is 14.9 hours, will then emit beta particles and gamma rays. Iron, similarly treated to produce iron-55, emits X-rays and the isotope has a half-life of 2.9 years. Cobalt-60, which is a commonly produced radioactive isotope, emits both beta and gamma radiation and has a half-life of 5.2 years. The last is the kind of reactor-produced radio isotope that finds use in the field of radiation chemistry. Others find uses as tracer elements.

Some atoms respond rather violently to the introduction of an extra neutron into their nucleus. For example, if a neutron is shot into the nucleus of uranium-235, the atom fissions with the liberation of a large amount of energy including both heat and radiation. For every atom of uranium fissioned, there are on the average 2.5 neutrons emitted which may in turn bombard other uranium-235 nuclei and cause their fission. Thus, if the process is allowed to proceed uncontrolled, we have a chain reaction and an atomic explosion. If, on the other hand, the release of the energy is controlled, we have the basis of the power reactor. The heat is used to produce steam, which in turn is converted into power. The

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radiation given off (as a byproduct in this case) is composed principally of neutrons and gamma rays, and may possibly be made useful in the field of radiation chemistry, as we shall try to illustrate later. Moreover, the fission products themselves are generally radioactive and will accumulate as ashes from the burning of the uranium fuel. These fission products may be recovered and in themselves constitute a source of radiation for various uses. It is obvious, therefore, that when power reactors are numerous we shall have at our disposal a very good source of large quantities of radioactive materials, presumably at low cost. This, with apologies to physicists, is a brief description of the field of nuclear technology.

TEXTILE APPLICATIONS

At least three papers have appeared recently that discuss in some detail the possible places where nuclear tecnology might find applications in the textile industry *(2, 3, 4)*. These are in reality a look into the future. An excellent summary of the present situation was made by K H Barnard, chairman of the AATCC Committee on Nuclear Radiation. It was reported that about fifty firms are actually using some form of nuclear radiation in connection with textiles. The report of the Committee stated, "The majority of those listed are using beta-ray thickness gauges, and the rubberizers of cloth lead all others in this connection. Several dye and chemical companies have done textile research work with this new tool and some of our leading textile schools report success; however, progress to date may be regarded as so much spade work. The full benefits will be harvested only when more general recognition is given to the infinite possibilities in the application of nuclear radiation to textile problems, both in research and in production control."

The use of beta-ray thickness gauges, the use of radiation as a dissipator for static, the use of fibers labeled with radioactive elements to study their relative movement during mechanical processing, the migration of color during printing, and the possibilities of fiber modification through radiation all have been discussed in the previous papers.

To give a complete report dealing with the future of nuclear technology in the field of textiles would only repeat the material that has already been presented. The purpose here will be to amplify briefly, certain areas where there appears to be some promise of the successful utilization of radiochemical techniques. It must be repeated and emphasized that the probability of success in some areas can only be determined by experimentation. Thus, at the present moment, it is not possible to make exact predictions for the future place of nuclear technology in our field of interest. There are three broad fields that need to be investigated. These are concerned with plant process control, analytical applications, and radiation chemistry.

PLANT PROCESS CONTROL——In the field of plant process control it may be said that thickness gauges are being used as controls in the field of rubberized textiles and coated fabrics. The use of beta gauges as a means of both determining and controlling the evenness of sliver, roving, and yarn has much promise for the future, but as yet has received no wide commercial acceptance. It is known that several companies are actively engaged in the production of models of equipment that might be used in textile processing in order to determine the economic feasibility of beta gauges in this application. It would appear that gauges of this type might also apply as means for the control of a padding operation. Padding plays an important part in warp sizing, in dyeing, and in finishing. More uniformity and better control of this operation is undoubtedly desirable. Studies have been initiated to find out whether an economic advantage may be gained, because of increased uniformity and better control, by the use of a beta gauge on a pad. There is still much exploratory work to be done before there will be an answer to this question.

ANALYTICAL APPLICATIONS ———All of us know that many of the analytical techniques we use are cumbersome and time-consuming. On the surface it appears that many of these might be made better through radiochemical techniques, although it is envisioned that, during the next several years, the applications will be more in the area of research than in routine procedures. Radioactive isotopes have already been used as tracers in testing the durability of finishing agents *(5)*, the efficiency of detergents in removing soil *(6)*, and in studying the adsorption of various materials on fibers *(7)*. We may expect this kind of work to be continued and to be broadened. The only limitations in a practical way that can be visualized in these connections are the availability of suitable materials containing the tagged atoms, and the necessity of having specially equipped laboratories and suitably trained personnel for this type of work.

Most of us are familiar with the AATCC monograph "Analytical Methods for a Textile Laboratory." It is quite possible that within the span of the next few years a number of analytical methods may be modified or simplified by utilizing isotopes or such well-known and standard techniques as isotope dilution, ion and isotope exchange and radio chromotography. These techniques permit accurate qualitative and quantitative analyses for such minute quantities that even micro techniques would be inadequate. A few methods of analysis that might lend themselves to radiochemical techniques are the determination of calcium chloride, available chlorine in hypochlorite solutions, water analysis, metallic constituents in textile materials, estimation of enzyme activity, estimation of starch, hydrosulfite analysis, manganese content of goods to be rubberized, oil analysis, determination and separation of phosphates in mixtures, and identification of finishes on materials. These are the more common determinations that should be and undoubtedly will be, investigated in the near future by radiochemical techniques.

Earlier it was stated that many of the elements may be made radioactive by bombardment with neutrons. This serves as a basis for a technique known as activation analysis. Radioactivity may be induced in a material containing trace quantities of elements by placing it in a neutron source. The nature of the radiation subsequently emitted, its energy, and its half-life, which may be determined by nuclear instrumentation, serve to identify the element in the sample. This technique has been widely use in other industries but not in connection with textile fibers. Recent experiments, however, have shown that this technique is applicable to fibers and some rather unusual trace elements have been found *(8)*. Phosphorus-32 was found in cotton and rayon. In acetate, mercury-203, iodine-126, and barium-140 were suspected. True synthetic fibers have shown a variety of elements to be present by this technique—chlorine-36 in nylon, Dacron, and polyethylene; potassium-40 in Dacron and polyethylene; silver-110 in Orlon. This method of analysis, which is not yet perfected for fibrous materials, may make it possible to determine whether trace elements as impurities have some influence on properties, particularly as related to such wet-processing operations as bleaching.

RADIATION CHEMISTRY——The applications that have been briefly discussed have not taken into consideration a more fascinating aspect of nuclear technology in the field of fibrous materials, ie, the development of new products through radiation chemistry. All organic materials tend to undergo changes when subjected to the influence of high-energy radiation, such as neutrons, gamma rays, beta particles, etc. The general effects of radiation on such materials as polymers are at least twofold. The substance may be improved with respect to certain properties through the medium of crosslinking, or may be degraded because of scission of its long-chain molecules. Thus, in one case, the effect is to increase the average molecular weight of the polymer, while in the other it is to decrease the molecular weight. Moreover, the properties of the irradiated materials indicate that both types of changes occur simultaneously but that in some polymers, at given levels of radiation, cross-linking reactions predominate while in others degradation reactions are more in evidence.

In an effort to establish the nature of the behavior of polymers, Bopp and Sisman *(9)* have irradiated a wide variety of plastics and elastomers in film form and have presented a rather complete report of their stability. With some reservations as to the exact order, they ranked the polymer stability toward radiation according to chemical structure. It was clearly demonstrated that hydrocarbon long-chain polymers as such, or bearing no side-chains other than phenyl groups, were predominantly crosslinked. Thus, materials such as polystyrene and polyethylene showed the greatest stability toward radiation and the changes in physical properties suggested crosslinking. Cellulose, of special interest in the field of textiles, and materials containing fluorine or chlorine showed little resistance to chain cleavage and were near the bottom of the list with respect to radiation stability. Polyesters and polyamides showed intermediate orders of stability.

More recently, there have been attempts to determine under well-controlled conditions the relative order of stability of fibers themselves *(10, 11, 12)*. Some rather extensive work has been done *(13)* that shows the changes that might be expected at given levels of radiation whether this radiation be thermal neutrons or gamma rays. The effects of the two types of radiation are apparently not exactly identical but there is enough similarity that the gross changes in the polymer, caused by equivalent dosages of the two types of radiation, are almost the same. Moreover, it has been shown that the changes produced in a fiber are not a function of dose rate but are merely dependent upon the total dose to which the sample is exposed *(13)*. Thus, it can be seen that, if we are to study the effects of high-energy radiation on fibers, either gamma or neutron sources may be used and that the changes produced are a function of total dose only. This will tend to simplify future work in this interesting field.

Efforts are being made to find those conditions that will tend to change the properties of fibers in a desirable direction; it is already known that this may be done. For example, polyethylene may be crosslinked with the result that its melting point is very remarkably increased. Dacron exhibits a fairly high order of stability toward radiation, and under certain conditions there is some evidence that it too crosslinks and the effect of crosslinking predominates over that of chain scission. Cellulosic fibers are degraded rather rapidly and in the presence of air and moisture the degradation appears to be largely that caused by oxidation—the oxidation is the type that produces alkali-labile linkages in the cellulose *(13, 14)*. When neutrons are used as the bombarding agent, effects of chain scission, in addition to those of oxidation, may be found.

We have tried to point out that we now have a background of information relative to the performance of a number of fibers during exposure to nuclear radiation. This will be extremely useful in future work in the area of possible new products in the textile field through the medium of radiation chemistry. Remembering that simple organic molecules, particularly those containing unsaturation, will undergo changes rather rapidly in the presence of radiation, some interesting possibilities in connection with fiber modification are suggested. Some of the simple organic compounds are converted with a rather high order of efficiency. This is typified by ethylene polymerization, styrene polymerization, or the copolymerization of butadiene and styrene. In fact, many vinyl polymerizations fit into this category. (The crosslinking of polyethylene, which in a sense might be considered a polymerization reaction, is however, of a low efficiency.) Thus, it would appear possible to polymerize certain selected materials either within fibers or on their surfaces. We are encouraged by the fact that some simple molecules may be converted at those levels of dosages that are not particularly damaging to the fibers themselves, even the relatively unstable cellulosic fibers. It is not possible to predict the effects of *in situ* polymerizations of this type on fiber properties but we can be optimistic and hope to develop fibrous materials having some very unusual characteristics by this procedure.

The above approach to the modification of fibers is somewhat outside the category of graft polymerization. The latter is accomplished through a free-radical mechanism. If two materials of different structure will form free radicals under the influence of high-energy radiation, these may join and the result is a union of the two through chemical bonds. Thus, one may be "grafted" to the other. It is anticipated that research in this area will be expanded over the next few years.

SUMMARY

A glance into the future of nuclear technology in the textile industry leads to the following conclusions. First, we might expect the application of isotopes in analytical procedures and use of gauges to control certain of our processes in the industry to become commonplace within a few years. Second, in the field of the development of new products through radiation chemistry the picture is not clear because work has only begun. The extent of our progress in this direction will obviously depend upon the effort expended by the textile and allied industries. Our present knowledge does suggest, however, the possibility of some new and interesting fibrous materials.

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Niagara Frontier Section———

REACTIVE DYESTUFFS IN THE DYEING OF CELLULOSIC TEXTILES*

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The principles underlying the application of a new class of cellulose reactive dyes are outlined. Details are given of the large variety of practical dyeing methods which can be employed with the Procion dyestuffs and the individual properties of these dyes are described.

INTRODUCTION

THE salient features of the physico-chemical structure of cellulose have become well-established during the last half century and it is now generally accepted that the cellulose molecule consists of a chain of anhydro-glucose units joined by glucoside linkages. In the fibrous state, which interests textile men, the individual chain molecules are closely associated by means of transverse hydrogen bonds between the hydroxyl groupings which exist along the fringe of the chain. In the crystalline region of the fiber, the number of transverse bonds is high, the structure is highly oriented and penetration of the lattice by external agencies, eg, dyes, is at a minimum. In the amorphous or intercrystalline regions the incidence of transverse bonds is low and these areas are more permeable to other molecules. It is in these permeable areas that we are allowed to push in the dye molecules which give us our commercially dyed cotton and rayon fibers.

There are three ways of attaching dyes to fibers, namely physical adsorption, mechanical retention, and chemical reaction. Until very recently only the first two of these ways have been of practical significance as regards the dyeing and printing of cellulose. Direct cotton dyes are attached to the fiber by physical adsorption and the basis underlying the attachment of vat, azoic, and sulfur dyes is one of mechanical retention. Chemical reaction of dyes with fibers has been under study for very many years, but until quite recently it was the belief that the cellulose hydroxyls were relatively inert and required severe conditions in order to promote reactivity. For example, even before the end of last century, Cross & Bevan (*1*) produced colored cellulose, but this was by a complicated sequence of reactions involving first the formation of soda cellulose. This was then benzoylated, nitrated, reduced, diazotized and coupled with phenolic compounds in turn to yield arylazobenzoyl celluloses. Such a complicated process of dyeing had little practical interest, but Cross & Bevans' work stimulated attempts to approach the task of producing permanent coloration of fibers by Schroeter (*2*), Karrer and Wehrli (*3*), and by Peacock (*4*) who worked along similar routes. McLaughton and Mutton (*5*) have given many literature references covering the formation of diazotizable cellulose derivatives. The severity, degradative effects, and duration of all these associated process studies precluded their commercial adoption. Other attempts to dye cellulose by chemical reaction along alternative approaches, for example, those of Kursanov and Solodkov (*6*) and Guthrie (*7*), failed to gain commercial significance for similar reasons [see also Evans (*8*)].

During 1954, the Dyestuffs Division of Imperial Chemical Industries made an important discovery. It was found that a dye molecule, R, containing one or more solubilizing sulfonic acid groups, S, and also containing one or more groupings, X, bearing a reactive halogen atom could, in the presence of an alkali, react with the hydroxyl groups along the fringe of the cellulose chain, to give a durable dye-fiber bond. This has been schematically explained by Vickerstaff (*9, 10*) as follows:

$$\text{S-R-X} + \text{HO-Cellulose} \xrightarrow{\text{alkali}} \text{S-R-O-Cellulose} + \text{HX}.$$

These reactive dyes were made available in 1956 under the tradename of Procion dyestuffs. The success of the first three members of the range, Procion Yellow RS, Procion Brilliant Red 2BS and Procion Blue 3GS led to a considerable extension of the range. At the present time there are 19 products, which may be classified as follows:

(Normal Cold Dyeing)	*(Special Applications)*
Procion Brilliant Yellow 6G	Procion Brilliant Yellow H5G
" Yellow R	" Yellow H
" Brilliant Orange G	" Brilliant Orange HGR
" Red G	" Scarlet H3G
" Brilliant Red 2B	" Brilliant Red H3B
" Brilliant Red 5B	" Brilliant Red H7B
" Blue 3G	" Rubine H2B
" Brilliant Blue R	" Printing Green B
	" Printing Green 5G
	" Brilliant Blue H7G
	" Blue HB

There is a significant difference between the Procion "H" dyestuffs and the normal Procion dyestuffs and this is detailed at a later stage in this paper.

PROCION DYESTUFFS—PROPERTIES, REACTIVITY AND GENERAL APPLICATION

Procion dyestuffs, which are powders easily soluble in water, are reacted with the hydroxyl groupings in the cellulose fibers by means of simple alkaline treatments. They can be applied from neutral solution, but they react only in the presence of an alkali. They will also react well with the hydroxyl groups in water and thus hydrolyze:

$$\text{S-R-X} + \text{HOH} \rightarrow \text{S-R-OH} + \text{HX}$$

*Presented October 25, 1957 before a joint meeting of the Niagara Frontier Section and the Ontario Section, Canadian Association of Textile Colourists and Chemists, at St Catherines, Ontario, Canada.

Because of this, during application, there is always competition for the dye between the fiber and the water present, thus two reactions are operating:

Procion dye + fiber → dyed fiber
Equation 1

Procion dye + water → unreactive Procion dye ..... *Equation 2*

Under the generally recommended conditions of application, Equation 1 proceeds to the extent of approximately 70%, while Equation 2 proceeds to about 30%. It is important to note, however, that the unreactive decomposed dyestuff is still completely water-soluble because of the sulfonic acid groups present and therefore any unfixed dyestuff can be removed readily from the goods subsequent to dyeing or printing.

Vickerstaff (*10*) has decribed experimental evidence which provides proof of the chemical reactivity of Procion dyes with cellulose. In spite of the dye-fiber union, Procion-dyed goods can still be re-dyed or over-dyed with orthodox or reactive dyes since the numbers of hydroxyl groups blocked by dye residues are relatively few in relation to the very large numbers available in cellulose. In cellulose triacetate fibers, where the hydroxyls are blocked by acetyl groups, no fixation of Procions occurs.

It is natural that reactive dyes must be unstable under adverse storage conditions, but this is true of many other dyestuff types which have been available for very many years. It is necessary to store the dyes in a cool place and the containers must be kept tightly sealed in order to avoid access of moisture and chemical fumes. Any decomposition which does occur will not affect the solubility of the dyestuff, but will result in a lower tinctorial yield. When dissolved in water, the Procion dyestuffs are more prone to decomposition, and solutions should preferably be neutral and stored cold until ready for use. Low concentrations of strong alkali are harmful, but moderate stability is obtained where low concentrations of weaker bases, eg, sodium bicarbonate, are present at room temperatures. Acid solutions tend to decompose the dyestuff, but at pH 7, solutions are stable at 45-50° C for at least 4 hours.

The normal Procion dyestuffs possess very high solubility in cold water and good stability to hard water up to 10° English hardness. Because of their anionic characters they are immiscible with cationic auxiliary products or cationic dyes; they are, however, completely compatible with anionic or non-ionic agents.

The Procion H brand dyestuffs are less reactive and have greater stability than the normal Procions although it is not recommended that solutions containing alkali should be stored for long periods. The H brands are dissolved by pasting in cold water, followed by dilution with hot water, and the solution should then be boiled.

Because of their novel character, the Procion and Procion H brands can be dyed on cotton and viscose rayon goods by a wide variety of discontinuous and continuous techniques. The proven sequences of operation established to date will be outlined in general terms.

DISCONTINUOUS (BATCHWISE) METHODS—— Close analogy exists between the techniques employed for the application of direct cotton dyestuffs and normal Procion dyestuffs to all forms of cellulosic textile materials. Orthodox dyeing equipment is called for, but there are some very important differences. The techniques involved in Procion dyeing are dependent upon certain fundamental properties of the reactive dyes. They are substantive to cellulose in the presence of common salt or sodium sulfate and, as in the case of direct cotton dyes, appreciable differences exist between the various individual Procion dyes in the matter of salt sensitivity. Unlike direct cotton dyes as a class, the normal Procion dyes show maximum exhaustion (and fixation) in the cold. This is of tremendous importance when the economics of steam consumption in the application of orthodox dye types is considered. Fixation of the Procion dye to the fiber is induced by addition of alkali to the dyebath. Low concentrations of soda ash or trisodium phosphate crystals for viscose rayon and cotton respectively produce the best results with respect to color value and fixation. The high wetfastness properties of the resultant Procion-dyed shades depend upon the stability of the dye/fiber bond, and when the dyestuff has reacted with the fiber, no levelling can take place.

The basic procedure followed in the dyeing of rawstock, skeins, packages and piece goods on the jig or in the winch vessel follows. The dyebath is set with dyestuff and water only, and dyeing is commenced cold. Common salt is added over a period of 20-30 minutes to promote dyebath exhaustion. Maximum leveling can be attained during this stage of the operation. Further exhaustion and fixation of the dyestuff on the fiber is created by addition of the alkali to the same bath, and at the end of a one to one and one-half hours dyeing process the unfixed dyestuff is removed by thorough rinsing and a hot soaping treatment.

TABLE I

Procion dyestuffs exhaustion and fixation behavior under optimum cotton dyeing conditions

Procion dyestuff	*Depth of shade (%)*		*Liquor:goods ratio (%) 5:1*	*30:1*
Brill Yellow 6GS	1.5	E_1	38.0	18.0
		E_2	79.0	38.5
		F	72.5	36.0
Yellow RS	1.5	E_1	95.0	75.0
		E_2	99.0	98.0
		F	80.0	80.0
Brill Orange GS	1.5	E_1	82.0	54.0
		E_2	99.0	97.0
		F	80.0	76.0
Brill Red 2BS	1.5	E_1	52.0	16.0
		E_2	87.0	68.5
		F	65.0	57.0
Brill Red 5BS	1.0	E_1	62.5	38.5
		E_2	91.0	73.0
		F	71.5	60.0
Red GS	1.5	E_1	16.0	6.0
		E_2	69.0	54.0
		F	61.0	45.0
Blue 3GS	1.5	E_1	42.0	17.5
		E_2	95.0	80.0
		F	72.0	63.0
Brill Blue RS	1.5	E_1	16.5	10.0
		E_2	94.0	86.5
		F	72.0	66.0

E_1—exhaustion with 25 g common salt per liter for 30 minutes at 20°C.
E_2—exhaustion after completion of fixation with alkali ($Na_3PO_4 \cdot 12H_2O$), 90 minutes.
F—fixation after 1.5 hrs dyeing and boiling 15 minutes in 2 g/l Lissapol NC.

A typical Procion dyeing curve is illustrated in Figure 1. From this it will be seen that Procion Bue 3GS has no affinity for viscose rayon in the absence of salt. By using 50 g/l common salt for 30 minutes, an exhaustion of approximately 40% is obtained under the conditions of dyeing used. On addition of five g/l soda ash, the exhaustion is boosted to approximately 90% during the next 50 minutes. Finally, after rinsing and soaping away the unreacted and mechanically held dyestuff, a 70% dye fixation results. Levels of exhaustion with salt alone, salt and alkali, and final fixation data for cotton under optimum dyeing conditions are quoted in Table I. It will be observed that very large variations exist between the present members of the range. In spite of this there is little difficulty in practice of producing perfectly uniform dyeings with mixtures from components of widely different properties. In the matter of shading to pattern in the alkaline salt bath, no difficulties are encountered, provided 15 minutes is allowed after each addition. The only exception to this applies when Procion Yellow

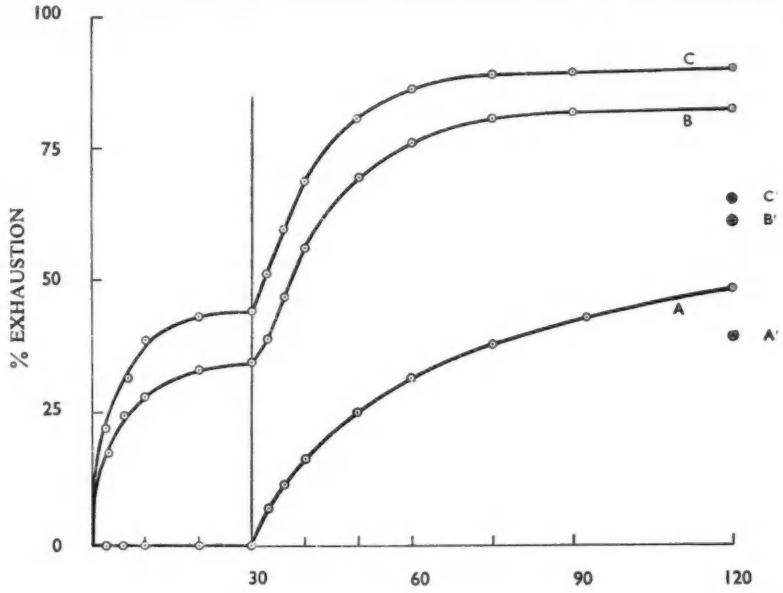

Figure 1
Procion Blue 3GS

1.5% shade, staple viscose rayon 35/1, liquor ratio 30:1, 20°C ± 1°C

A—no salt
B—25 g/l common salt
C—50 g/l common salt
} 5 g/l soda ash added after 30 minutes

A', B', C'—% fixation after treatment for 15 minutes in 2/1000 Lissapol NC at 95°C.

RS—the most highly substantive product of the series—needs to be added in relatively large proportion. In this case it is better to drop the bath partially or wholly and shade in a fresh cold bath. Reproduction of formulas from standard laboratory conditions to standard bulk conditions is excellent.

While certain members of the Procion H range can be fixed by batch-wide dyeing techniques, such application is not recommended except in the case of Procion Brilliant Blue H7GS, for the following reasons:

a) low fixation is achieved, and
b) they are very sensitive to temperature variations.

They cannot be applied from cold dyebaths and generally demand temperatures ranging from 55-85° C, depending on the individual dyestuff properties. The fixation on cotton is too low to be of much practical value in batchwise dyeing. In the case of viscose rayon, the fixation obtained from Procion Yellow HAS, Procion Scarlet H3GS and Procion Rubine H2BS is of an acceptable order; but because of sensitivity to small temperature variations, mixture shades would present serious practical problems.

Although the fixation efficiency of Procion Brilliant Blue H7GS is only moderate, there is considerable interest in the product for batchwise dyeing in view of its brilliant turquoise shade and high wetfastness properties. This dyestuff is applied at 85° C with up to 30 g/l common salt or sodium sulfate and is fixed by the addition of trisodium phosphate (five to 10 g/l crystals for rayon) or caustic soda (two g/l for cotton). Finally the goods are thoroughly washed in order to remove unfixed dyestuff. This product can be shaded to the yellow or red side by the use of small quantities of Procion Yellow HAS or RS or Procion Brilliant Red H7BS.

CONTINUOUS METHODS——It is in this field of application that the Procion and Procion H range excel because of the wide variety of systems available.

THE PAD-BICARBONATE PROCESS——This is of interest only for normal Procion dyestuffs but has proved to be the most popular continuous method because of its simplicity. It is in fact the simplest approach to Procion dyeing in that the dyestuff and reaction catalyst are simultaneously applied to the fiber by conventional padding methods; this is followed by heating (drying) to promote rapid reaction. Fixation of Procion dyestuffs on the fiber proceeds at pH values greater than 7, but it is only when the pH is greater than 9.5 that the rate is sufficiently high for most continuous dyeing methods. Padding under strongly alkaline conditions is not attractive since hydrolysis of the reactive groups X in the normal Procion dye system takes place. Sodium bicarbonate yields solutions in the region of pH 8.4 and is sufficiently mild to allow its addition to cold Procion solutions. During the subsequent drying operation, the bicarbonate loses carbon dioxide yielding sodium carbonate and a pH in the region of of 10.5—11; under these conditions fiber-dye reaction is rapid.

The critical stage in the pad-bicarbonate process is the heating or drying stage after padding. In this operation at least two simultaneous reactions which favor dye fixation must be taken as near to completion as possible. For this reason the factors of temperature, time and rate of evaporation of water require control if reproducible shades are to result. The importance of control becomes even more significant when it is realized that the low substantive Procions will tend to migrate to the drying surfaces of the textile material. Migration is controlled by the addition of sodium sulfate to the padding trough, and experience has shown that exceedingly smooth and solid shades, free from weft bars, warp streaks, skitteriness and other common imperfections due to migration faults, can be obtained in pale and medium depth shades by both hot-flue and can-drying systems. Where stacks of cans are employed, it is necessary to ensure that only slow heating and drying takes place on the first series of cans. A typical pad liquor recipe is as follows:

Pad at 20-30°C with maximum nip expression
0-20 g/l Procion dyestuff
5-20 g/l sodium bicarbonate
5-20 sodium sulfate
2 g/l wetting agent (anionic or nonionic).
Dry at 100-120°C.

Finally the goods are thoroughly washed with water and soaped at the boil on a normal open-width 6-8 box range.

Where goods are to be resin finished, washing off between dyeing and resin impregnation may be omitted so that a continuous sequence of pad, dry, pad resin, dry(bake), wash off can be employed.

Procion H dyes, because of their different reactive system, cannot be applied by this process.

PAD - BICARBONATE - UREA PROCESS——It is known that the efficiency of the pad-bicarbonate-dry process just described decreases as the depth of shade increases, and this is particularly the case when concentrations of Procion dye exceed 20 g/l. It has been shown that the addition of 200 g/l urea gives a two- to fourfold increase in value in Procion dyeing at depths greater than 20 g/l Procion with the following:

Yellow RS
Brilliant Yellow 6GS
Brilliant Orange GS
Red GS
Blue 3GS
Brilliant Blue RS.

Use of this process also enables Procion Brilliant Blue H7GS to be applied alone or in mixture with Procion Brilliant Yellow 6GS to yield exceptionally brilliant greens. A good, basic formula for padding at 25-30° C by this process is as follows:

20-60 g/l Procion dyestuff
10-20 g/l sodium bicarbonate
150-200 g/l urea
0-10 g/l sodium sulfate
2 g/l Lissapol N.

After padding in a small volume trough to maximum expression, the goods are hot-flue dried within the 100-120° C range. The goods are finally washed off and soaped in order to remove unfixed dye.

PAD - BICARBONATE - STEAM PROCESS——This further development of the pad-bicarbonate system has certain commendable features, namely, the omission of the drying stage, which eliminates difficulties that may arise due to migration in unsuitable drying equipment and yields solid and well-penetrated dyeings. The process is also particularly attractive to owners of pad-steam equipment. The padding liquor detailed for the normal pad-bicarbonate-dry process is satisfactory, and a steaming time of 30-60 seconds at 100-105° C is adequate. Washing and soaping is completed on the open soaper range.

On viscose rayon this process yields good color value at all depths with all Procion dyes (H brands excepted), but on cotton only Procion Yellow RS, Procion Brilliant Orange GS and Procion Brilliant Blue RS can be built up to full shades. Full shades on cotton can be obtained, however, from Procion Brilliant Yellow 6GS, Procion Brilliant Reds 2BS and 5BS, Procion Red GS and Procion Blue 3GS by drying or partial drying prior to the steaming operation.

TWO-STAGE PADDING METHODS——These techniques consist of padding on dyestuff followed by padding in caustic alkali with or without intermediate drying. Such methods are of interest only for cotton fabrics since they yield frosty and barry dyeings on spun rayon; the high alkalinity required, coupled with the tension created, has an unfavorable effect on the handle of rayon.

Two processes of this class have been adopted by the trade, namely 1) pad, dry, pad caustic soda in saturated salt, steam sequence, and 2) pad, wet—caustic/salt fix in the Standfast machine. Both processes give excellent quality dyeing, but the pad-steam route has lost favor to the simpler pad-carbonate routes already described, except where full shades are demanded. Adoption of these processes naturally depends largely upon the equipment available.

The Procion H brands may be continuously dyed by either of two methods: 1) pad dyestuff, dry, salt/caustic pad, steam, wash and soap, or 2) pad alkaline dyestuff, dry, steam, wash and soap.

In this case the pad liquor contains Procion H dyestuff, a wetting agent, five to 20 g/l. sodium sulfate and 20 g/l. soda ash. In the case of Procion Rubine H2BS, an addition of 50 g/l. urea to the pad liquor increases the yield. After drying, the goods require steaming for four to eight minutes at 100-105°C and it is generally necessary to employ a direct dye steamer or a printers ager. Finally the goods are rinsed and soaped.

SEMICONTINUOUS METHODS——A very novel system of dyeing with the Procion dyestuffs developed from the observation that, when solutions of sodium bicarbonate and dyestuff are padded on to cellulosic goods and prevented from drying out, fixation of the dyestuff occurs even in the cold. The rate of fixation is proportional to the time and temperature of the storage conditions. The resultant process of dyeing, called the pad-batch process, operates on a sequence of pad color and alkaline catalyst, batch or roll, wash off, and dry.

Spun viscose rayons are dyed as follows: a solution of dyestuff, sodium bicarbonate and wetting agent is prepared in the cold as for the "pad-bicarbonate-dry" process described earlier. The fabric is padded cold, wound on a batching roller, covered in a polyethylene or similar sheet to prevent drying out and evaporation, and kept turning for periods of up to 24 hours. Finally the goods are washed off and soaped to remove unfixed dyestuff. If the batching temperature is raised to 50°C or higher, eg, in a Svetema (Rhydboholm) Pad-Roll machine, the storage time can be decreased to one-half to six hours depending upon the depth of shade. The Procion H brands can be applied in the pad-roll machine, but soda ash rather than sodium bicarbonate must be incorporated in the pad liquor and batching temperatures of 90-100°C employed.

Cotton fabrics can be dyed on a similar cold pad-cold batch system or on a pad-roll machine. In the former case, the normal Procions are best applied from a pad trough to which individual feeds of dye and soda ash are metered via a small premixer. This precaution is necessary because of the high reaction rate of soda ash and dye. Cold batching for three hours is adequate in this case.

When Procion H brands (padded with soda ash from the same storage solution) are employed, it is necessary to batch hot in the pad-roll machine.

FASTNESS PROPERTIES——In wetfastness properties, eg, fastness to severe soap and soda washing, with certain exceptions, the new dyes are equal to those of vat dyes. They are, however, not entirely fast to chlorine and bleaching treatments generally, but this is not a necessary characteristic of reactive dyes as a class. They are unaffected by domestic washing agents containing peroxygen compounds, but they have only borderline resistance to peroxide piece-bleaching and cannot be recommended for piece-bleaching styles. The dyes are also more sensitive to acid solutions than vat dyes and are unsuitable for processes of union dyeing involving acid cross-dyeing. Fastness to light, in general, is comparable with many dyes of the vat range, and this high fastness does not fall even in very pale shades as is the case with certain vat dyes and most azoic and direct dyes. They do not promote catalytic tendering of cellulose on light exposure. Procion-dyed goods are unaffected by organic cleaning solvents.

In the case of resin finishing with urea- or melamine-formaldehyde and cyclic resins, the Procion dyes show some variation in behavior from product to product; but by selection it is possible to obtain shades which satisfactorily withstand the treatment with only a minimum effect on lightfastness.

Against *vat dyes*, the Procions show the following advantages:

a) They retain their high fastness to light and to washing in pale shades. This is not true of all vat and soluble vat dyes.

b) In certain circumstances, eg, on tightly woven fabrics, the Procion dyes give improved surface appearance and penetration.

c) Reduction and oxidation processes are not involved. The dyeing processes are easily controlled. Greater versatility in application methods and equipment requirements.

d) The shade of the Procion Brilliant Reds cannot be equalled by anthraquinone vat dyes and the light fastness of Procion Brilliant Yellow 6GS cannot be equalled by vat dyes.

Against azoic combinations:

a) Procions offer better rubbing fastness.

b) In general, they yield superior wash- and lightfastness in pale shades.

c) A wider range of shades is possible.

Against direct dyes:

a) Greater superiority in respect of wet- and washfastness is shown by Procions.

b) Lower physical affinity for cellulosic fibers and greater suitability for continuous dyeing.

c) Very much higher rate of fixation at the steaming stage in pad-steam techniques.

e) The use of dye-fixing agents is unnecessary.

Against pigment coloration:

a) Superior penetration and rubbing fastness.

b) No adverse effects on handle.

c) Complete resistance to dry-cleaning.

d) No baking treatments or expensive auxiliaries are involved.

CONCLUSION

Sufficient has been said to indicate that the process of reacting dyes chemically with cellulose is no longer a theoretical speculation but a successful practical fact. The application techniques are novel. There are still advantages and limitations in this field as with every other dyestuff class. The use of reactive dyes, however, does provide an answer to a pertinent problem of the past, namely, to produce water-soluble dyes which have good leveling properties and powers of penetration and are simple to apply on orthodox equipment while simultaneously giving dyeings of very high wetfastness properties.

The existing ranges of Procion and Procion H dyes must be regarded as the forerunners of a potentially very large class of dyestuffs, and as the range continues to broaden in type, quality and number, there is little doubt that "reactive dyeing" will become one of the major standard practices.

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ACTIVITIES OF THE LOCAL SECTIONS

Pacific Southwest Section Meeting

April 18, 1958

Barraclough's Restaurant, Los Angeles, Calif

(All captions read l to r)
(Photos courtesy of A H Roberts, Jacques Wolf & Co)

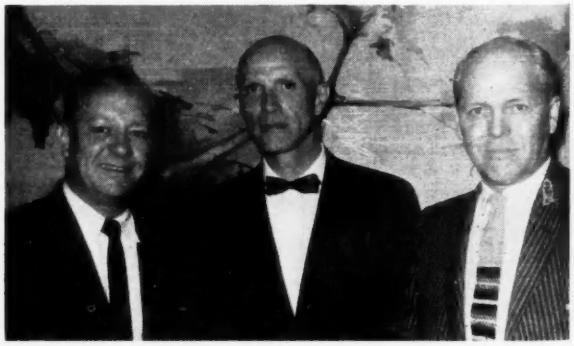
PACIFIC SOUTHWEST SECTION OFFICERS (l to r): F Ahl, Du Pont, treasurer; W Kramer, Jenkins Wright, secretary; H Ellsworth, West Coast Carpet Dyers, chairman; P Noonan, Dyemasters, vice chairman

C W Dorn, national chairman, AATCC Executive Committee on Research; Mr & Mrs M B Harris, National Institute of Drycleaning

T Smock, General Dyestuff; G P Paine, executive secretary, AATCC; R Coleman, National Dyeing & Finishing Corp

E Lindquist, Geigy; G O Linberg, AATCC president; J Nehmens, Du Pont

S M Edelstein, Dexter Chemical Corp, national chairman, Archives Committee; Mrs Edelstein; S Springer



E Lindquist, Geigy; C A Sylvester, Du Pont, national chairman, AATCC Technical Committee on Research; R Fliegel, Allied Dyers

Northern New England

The annual joint meeting of the Northern New England Section and the Lowell Technological Institute Student Chapter was held May 9, 1958 at the Institute campus in Lowell, Mass.

Two student papers were presented: "Effect of Regain of Cotton Fabrics on Resin Treatments" by Yoon-chai Lee; and "Effect of Degree of Fulling on Migration Rate of Water", by Marino Ocampo. Mr Lee's paper was read by George A Scagos, and Mr Ocampo's paper was read by George A Lyna.

Among those attending the meeting were George O Linberg, AATCC president; Ernest R Kaswell, vice president, New England Region; George P Paine, executive secretary; and Martin J Lydon, president, LTI.

Rhode Island

The Rhode Island Section meeting originally scheduled for March 21, but postponed due to inclement weather, was rescheduled and held May 16th at the quarters of the Providence Engineering Society, Providence, RI, with approximately 75 in attendance.

Speaker of the evening was Joseph J Iannarone Jr, E I duPont de Nemours & Co, Inc, whose subject was "Continuous Procedures for Dyeing Synthetics and Blends". Previous to this talk, the film "Color Magic", sponsored by the Interchemical Corp, was shown with a brief commentary by Matthew Quigley.

Prior to the meeting, an informal dinner was held at Johnson's Hummocks Grill, Providence.

Western New England

On Friday evening, May 16, 1958, the Western New England Section held its annual ladies night at Rapp's Paradise Inn, Ansonia, Conn, with 85 members and guests in attendance.

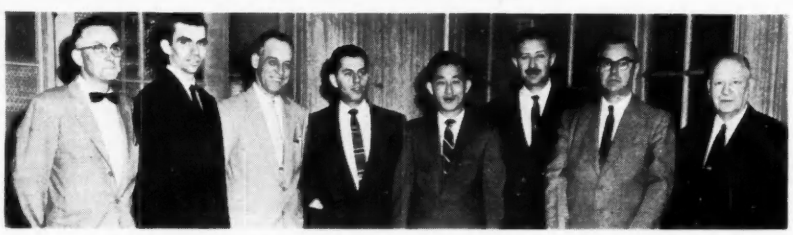
Speaker of the evening was Sidney M Edelstein, Dexter Chemical Corp, who told some "Strange and Humorous Stories of Our Past".

Towards the end of the dinner hour, the audience was entertained with a singing program by a chorus of twenty from the Ansonia-Shelton Chapter of Barber Shop Quartettes.

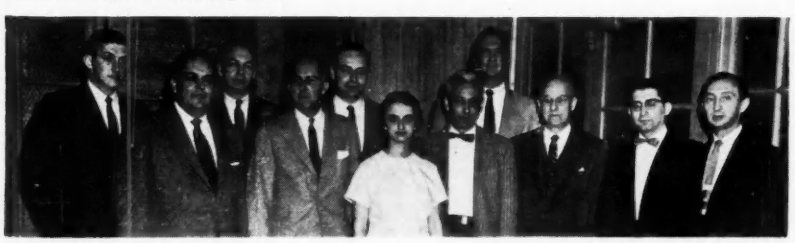
Guests in attendance included George O Linberg, AATTC president; Ernest R Kaswell, AATCC vice president, New England Region; George P Paine, executive secretary; and Norman A Johnson, editor, *American Dyestuff Reporter*.

Joint NNE-LTI Meeting • Lowell, Mass. • May 9, 1958

(L to r): Martin J Lydon, LTI president; George O Linberg, AATCC president; Maurice I Seifer, chairman, LTI Student Chapter and recipient of the AATCC award; Edward B Bell, chairman, NNE Section; George R Griffin, chairman, LTI Chemistry Division; R Carl Freeman, recipient of the Olney book award.



(L to r): John R Markgren, NNE dining committee chairman; George H Lyna, student speaker; Prof John J McDonald, LTI; George A Scagos, student speaker; Yoon-chai Lee, author of paper; Marino Ocampo, author of paper; Prof John H Skinkle, LTI; Prof emeritus Elmer E Fickett, LTI.



(L to r): Vernon H Ure, vice chairman, LTI Student Chapter; Henry X DeRedon, NNE outing chairman; George P Paine, executive secretary, AATCC; Robert D Robinson, vice chairman, NNE Section; Ernest R Kaswell, vice president, AATCC; Athena Letsou, secretary, LTI Student Chapter; Prof Fritz F Kobayashi, NNE sectional committeeman; Edward J McNamara Jr, NNE Intersectional Contest committeeman; Azel W Mack, secretary, NNE Section; Louis Port, student chairman of the technical program; Prof Robert J Peirent, LTI Student Chapter faculty advisor.

Hudson-Mohawk

The Annual Ladies Night Dinner Meeting of the Hudson-Mohawk Section was held Friday, May 16, at the Chelsea House, Tribes Hill, NY, at which Chairman Edward Chevrette, Apex Chemical Co, presided. A brief business meeting followed a cocktail hour and dinner attended by 82 members and wives.

The Dr Jack Epelberg Memorial Award for 1958 was presented to Walter Drautz, General Aniline Works, as the person contributing most to the betterment and welfare of the Section.

The following slate of officers was invested for the 1958-59 season: *Chairman*—Maurice Fishman, Lee Dyeing Co; *Vice chairman*—Floyd J Szurek, Mohasco Industries, Inc; *Secretary*—Achilles Mafilios, Ritter Chemical Co; *Treasurer* — Walter Drautz, General Aniline Works.

Featured speaker at the meeting was Janet Crawford, E I duPont de Nemours and Co, Inc, who discussed "Garment Making to Garment Testing."

The 1958 outing will be held at the Antler's Country Club on June 20.

VOLUME 3

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Hudson-Mohawk Section Ladies Night Meeting • Tribes Hill, N Y • May 16, 1958

PRESENTATION OF DR JACK EPELBERG MEMORIAL AWARD—L to r: Irwin Smith, Surpass Chemical Co; Walter Drautz, General Aniline Works, recipient of the award; Albert Herrmann, General Aniline Works

NEWLY INSTALLED HUDSON-MOHAWK OFFICERS AND GUEST SPEAKER—L to r: Walter Drautz, General Aniline Works, treasurer; Maurice Fishman, Lee Dyeing Co, chairman; Janet Crawford, E I duPont de Nemours & Co, Inc, guest speaker at the May 16th meeting; Floyd J Szurek, Mohasco Industries, Inc, vice chairman; Achilles Mafilios, Ritter Chemical Co, secretary

SEATED AT THE HEAD TABLE—L to r: Mrs Irwin Smith, Walter Drautz, Mrs Drautz, Maurice Fishman, Mrs Fishman, Edward Chevrette, Mrs Chevrette, Janet Crawford, Floyd J Szurek, Mrs Szurek, Mrs Kapredis, Mrs Mafilios, Achilles Mafilios

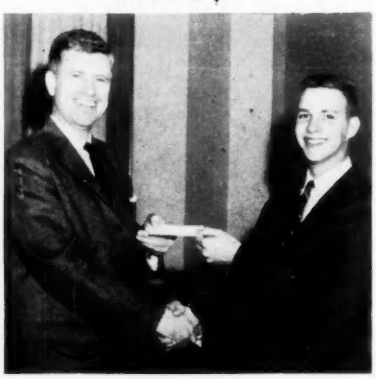
Mid-West

The 1958 Spring meeting of the Mid-West Section was held at the Netherland Hilton Hotel, Cincinnati, O, on April 19, more than 50 members and guests in attendance.

Chairman Jack G Kelley, E I duPont de Nemours & Co, Inc, presided.

Edwin I Stearns, chairman of the Section's Scholarship Committee, read a letter of appreciation from Victor C Braun Jr, recipient of the scholarship awards in the past, inviting all members of the Section to attend graduation exercises at Philadelphia Textile Institute.

Dr Stearns, upon the recommendation of the Scholarship Committee, presented the 1958-59 Award to Kenneth M Harms Jr, who will also attend PTI.



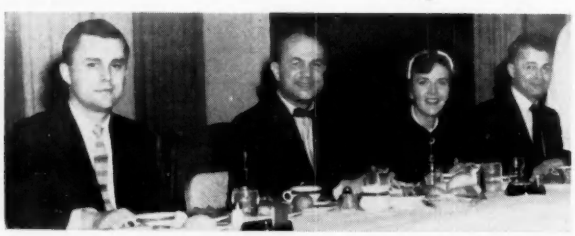
Edwin I Stearns (left) chairman of the Mid-West Section's Scholarship Committee, presents the 1958-59 Scholarship Award to Kenneth M Harms Jr of Rochelle, Ill, during the Section's April 19th meeting.

Lee Johnston, chairman of the Section's Technical Committee, reported that excellent progress was being made in the preparation of a paper for the 1958 Intersectional Contest.

Vice chairman J L McGowan, Morgan Dyeing & Bleaching Co, introduced the speaker of the afternoon, Helen G Sommar, fiber development chemist, B F Goodrich Chemical Co. Miss Sommar spoke on "The Dyeing of Darvan Dinitrile Fiber".

Following a cocktail party and dinner, Elliott Morrill, chairman of the forthcoming National Convention, presented a progress report.

The evening session featured a film, "This is Color", through the courtesy of Interchemical Corp.



SPEAKER'S TABLE—MID-WEST SECTION MEETING OF APRIL 19, 1958 (l to r): Frank H Gurry, Aurora Bleachery, Inc, treasurer; James L McGowan, Morgan Dyeing & Bleaching Co, vice chairman; Helen G Sommar, B F Goodrich Chemical Co, guest speaker; Walter H Sites, Ciba Co, Inc, secretary; Jack G Kelley, E I duPont de Nemours & Co, Inc, chairman; J Gordon Stott, Ciba Co, Inc, councilor; Arthur I Hultberg, Bear Brand Hosiery Co, councilor; Elliott Morrill, The Best Foods, Inc, AATCC vice president and 1958 Convention Chairman; Joseph H Jones, Phoenix Dye Works, councilor.

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

58-11

Education: St Anslem's College, chemistry; Lowell Technological Institute, BS, textile chemistry.

Experience: 8 years' well-rounded experience all departments, all fibers, as chemist colorist for textile printing company.

Age: 36; married; 5 dependents; references.

Position desired: Textile chemist; development; demonstration; technical service.

Location desired: New England or Middle Atlantic States.

6-2, 6-16

58-12

Education: BS, chemistry, Polytechnic Institute of Brooklyn; elastomer technology, New York Rubber Group.

Experience: 15 years; development engineer for surgical supply manufacturer; chemist, technician in rubber products, chemicals and minerals; plant chemist for tire fabrics manufacturer.

Position desired: Laboratory research and development, technical service.

Location desired: South or West Coast.

Age: 36; married; one dependent; references.

6-16, 6-30

58-13

Education: BS, chemistry & dyeing, Philadelphia Textile Institute.

Experience: 2 years, chemist, felt fabricating firm; 2 years, chemist, dyestuff manufacturer.

Position desired: Textile chemist in application research and/or technical service.

Location desired: New York City. Will consider relocating.

Age: 26; married; two dependents; references.

6-16, 6-30

AATCC Calendar

COUNCIL

Sept 19 (Charlotte, NC); October 30 (Conrad Hilton Hotel, Chicago, Ill); May 1959 (Montreal, Canada)

NATIONAL CONVENTIONS

Oct 30-Nov 1, 1958 (Hotel Conrad Hilton, Chicago); Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); September 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

DELAWARE VALLEY SECTION

Sept 12 (Wilmington Meeting), Oct 17, Dec 5

HUDSON-MOHAWK SECTION

June 20 (Annual Outing, Antler's Country Club, Ft Johnson, NY)

NIAGARA FRONTIER SECTION

June 27 (Annual outing); Sept 26 (Niagara Falls, Ont); Oct 24 (joint meeting with CATCC at St Catherines, Ont); Dec 5 (Buffalo, NY); Feb 20 (Niagara Falls, Ont); April 4 (Hamilton, Ont—joint meeting with CATCC)

NORTHERN NEW ENGLAND SECTION

Sept 12 (Outing—Wachusett Country Club, West Boylston, Mass); Oct 17 (QM Research & Development Ctr, Natick, Mass); Dec 5 (Hotel Vendome, Boston, Mass); Jan 16 (Colonial Club, Lynnfield, Mass)

PIEDMONT SECTION

Sept 19-20 (Hotel Charlotte, Charlotte, NC)

RHODE ISLAND SECTION

Sept 26 (Management Night — Warwick Country Club); Oct 23 (Providence Engineering Society); Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence)

SOUTH CENTRAL SECTION

Sept 13 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

Sept 13 (Ida Cason Callaway Gardens, Chipley, Ga); Dec 6 (Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

Sept 26 (Hartford, Conn); Oct 24 (Annual Meeting—Rapp's Restaurant, Shelton, Conn; Dec 5 (Rapp's Restaurant, Shelton, Conn)

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Future Papers

The following material has been submitted to date to the publishers of American Dyestuff Reporter. Subject to the approval of the AATCC Publications Committee, it will appear in the Proceedings in future issues.

Authors, section officials, and committee chairmen are required to inspect this list and notify the publishers if there are any omissions.

"Pollution Control of New England Interstate Waters"—Joseph C Knox, New England Interstate Water Pollution Control Commission

"Disposal of Combined Textile Finishing Wastes and Domestic Sewage"—George C Bogren, Weston & Sampson

"Treatment of Mixtures of Textile Wastes and Domestic Sewage. IV—Research in Various Methods of Treatment"—R Hobart Souther and Thomas A Alspaugh, Cone Mills Corp

"Combined Treatment—Bleachery Waste and Domestic Sewage"—John L Brown Jr, Cannon Mills Co

"The Colorimetric Properties of Bleached Cotton"—E S Shanley, Arthur D Little, Inc

"The Mechanism of Dyeing Orlon 42 Acrylic Fiber"—T Vogel, J M A deBruyne and C L Zimmerman, American Cyanamid Co

"Practical Emulsions" — Paul Becher, Atlas Powder Co, Inc

"The Dyeing of Nylon and Dacron Polyester Fiber Yarns"—G T Hug, E I duPont de Nemours & Co, Inc

Recent Developments in the Chemical Finishing of Textiles", Fred Fortess, Celanese Corp of America

"Wash-Wear Resins for White Cotton Fabrics"—Hector C Borghetty, Rohm & Haas Co

"Nylon Carpet—Growth and Technology"—Graham C Richardson, E I duPont de Nemours & Co, Inc

"Dyeing Darvan Dinitrile Fiber"—Helen G Sommar, B F Goodrich Chemical Co

"Effect of Atmospheric Contaminants on Lightfastness Testing"—AATCC Subcommittee on Colorfastness to Light

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Your prepaid subscription received promptly will insure complete delivery this year of this tremendously valuable work on the free world's dyestuffs and pigments in commercial use. Published by the Society of Dyers and Colourists (British) and the American Association of Textile Chemists and Colorists, these four volumes represent ten years of intensive work in assembling and editing the data. They include approximately 3000 pages of application and fastness properties of coloring matters as furnished by world manufacturers, chemical and structural information, characteristic reactions, index of products and trade names, fastness tests and rating methods, new and old COLOUR INDEX NUMBERS, Schultz and AATCC prototype numbers and a Hue Indication Chart.

Further Particulars from

American Association of Textile Chemists and Colorists

PO Box 28, Lowell, Massachusetts

• PATENT DIGEST •

DYEING POLYESTER FIBERS with Hydroxyanthraquinones. C,4,07

Brit Pat 779,803 (Farbenfabr Bayer—July 24, 1957)

Hydroxyanthraquinones, such as 1-2-dihydroxy anthraquinone (Alizarine VI, *CI* 59850), quinizarine (1-4-dihydroxy anthraquinone, *CI* 58050), 1-2-4-trihydroxyanthraquinone (Purpurine, *C I* 1037) and so on can be dyed on cotton only by using a metal mordant, such as an aluminum salt.

Surprisingly, it has been observed that polyester fibers can be dyed with dyes of the above class without applying a metal mordant. Yellow, brown, orange or red dyeings are obtained according to this method; the shades vary with the number and position of the hydroxysubstituents.

Example: Linear polyester fibers are dyed with a suspension of 10 g 1-4-dihydroxy anthraquinone in 40 lit aqueous dyebath, by starting at 50° C, raising to the boiling point and dyeing for 1½ hrs at the boil. A clear orange of good fastness properties is said to result.

Other brands of this group mentioned in the specification are 1-hydroxy anthraquinone, 1-5 or 1-8 dihydroxyanthraquinone and 1-4-5 trihydroxy anthraquinone. Carriers, eg, benzoic acid, may be added.

FLAMEPROOFING———Haloalkyl-Alkenyl Phosphonates. G,2,03

USPat 2,803,562 (Dow Chemical Co——Erbel, Kenaga——Aug 20, 1957)

This patent relates to flame-retarding treatments of all kind of cellulosic material, such as textiles, paper and wood.

It has been observed that compounds derived from PCl_3 by substitution of haloalkyls for two valencies and an unsaturated chain for the third, thus bis(2-haloalkyl)-alkenylphosphonates, are suitable for the above purpose. Examples are bis (2-chloro- or bromoethyl)-yinyl phosphonate and bis(2-chloropropyl)-propenylphosphonate. The saturated and unsaturated chains must have the same content of C-atoms.

These water-insoluble products are applied from organic solutions.

Example: Strips of canvas duck were dipped into a 25% solution of bis(2-chloroethyl)-vinylphosphonate in aromatic mineral spirit; after the solvent was volatilized, an outstanding flame-retardant effect could be observed.

Among the references cited by the Patent Office:

USPats 2,632,768 and 2,636,027 (Eastman Kodak/1953) describe methods for preparing polyalkenylphosphonate esters and alkylesters of alkylphosphoric acid respectively.

USPat 2,725,311 (Dow Chemical Co/1955): flameproofing with solvent solutions of a bis(monohaloalkyl)-monohaloalkane phosphonate.

PAUL WENGRAF

CORRECTION

In "Patent Digest" of February 24, 1958, page 131, first column, the abstract refers to US Patent 2,766,868 (Sayles Finishing Plant—Russell, Allen—Jan 8, 1957), rather than US Patent 2,776,868.

FLAMEPROOF TEXTILES———Halonitrides of Phosphorus Reacted with Ammonia. G,2,03

USPat 2,782,133 (Comp Fr Mat Col——Vallette ——Feb 19, 1957)

Standard flameproofing processes based on the use of water-soluble phosphates, eg, ammonium phosphate, do not withstand bad weather. Therefore, many attempts have been made to use water-insoluble phosphorus derivatives; for instance, products obtained by the action of phosphorus oxychloride or similar compounds on ammonia. One of the main drawbacks of these methods is the formation of large amounts of ammonium chloride, which is often very harmful to the fibers.

The problem reportedly has been solved by reacting halonitrides of phosphorus with *dry ammonia*. The products are water-insoluble and are applied from solvent solutions; they can, however, be completely dissolved by hydrolysis in water, probably by forming *polyphosphinates,* which can be applied from aqueous solutions to the fibers and insolubilized therein by a simple heat treatment.

Phosphorus halonitrides of the formula $(PNCl_2)_n$ are dissolved in an inorganic solvent, eg, carbon tetrachloride. Upon the introduction of anhydrous ammonia, halogenamines of the constitution $(P_3N_3Cl_5NH_2)_n$ and $(P_3N_3Cl_4(NH_2)_2)_n$ settle out and can be separated by filtration. It is also possible to carry out the transformation of phosphorus halides into nitrides by reaction with ammonium chloride and the further step of amination with dry ammonia in the same solution. Finally the above-mentioned halogeno-amines are hydrolyzed in an aqueous solution at 80-100°C and thus made ready for use. Impregnated fibers are heated to 100-170°C, preferably after drying first in open air.

Example: Phosphorus pentachloride and pulverized ammonium chloride were refluxed in tetrachloroethane, the excess NH_4Cl was filtered off and the solvent evaporated. The dry phosphorus chloronitride was dissolved in anhydrous carbon tetrachloride and dry ammonia was bubbled through the solution at maximum 10° C until no more precipitate formed. The insoluble product was dissolved at a ratio of 1:5 in boiling water. A cotton fabric immersed in this solution, squeezed, dried in the air and heated for four minutes to 160° C reportedly was rendered durably flame resistant; it did not show any afterglow and the hand was not substantially changed.

Among the references cited by the Patent Office:

USPat 2,334,710 (General Cable Corp/1943) describes a flexible, moisture-resistant, nonflammable jacket for insulated conductors. It is comprised of a layer of inorganic fibers saturated with polymerized nitrogen halophosphide.

USPat 2,637,704 (Monsanto Chem Co/1953): a flameproofing composition contains a condensate of polymeric phosphonitride halide . . . $(PNCl_2)_n$ . . . with chloroaniline plus a compound of the urea group, such as urea, guanidine, etc.

Chem Abst 33, 9177[5] (1939) presents an abbreviated translation of an article by Ficquelmont in *Ann Chim* 12, 169-280, regarding constitution of phosphonitrile polymers and reactions thereof.

DYEING OF POLYACRYLIC FIBERS———Reaction Products of Cupric Salts and Phenylphenols Used. C,4,07

USPat 2,796,318 (Deering Milliken Res Corp——Evans——June 18, 1957)

The preamble to this patent points out certain disadvantages inherent in the standard cuprous-ion dyeing method and particularly the fact that the addition of the reducing agent to

the dyebath is critical, requiring complicated and close controls in order to obtain satisfactory results. It might be most desirable to avoid reduction while working faster than is possible with the cuprous-ion method.

The current invention calls for the *simultaneous use of cupric salts, a phenylphenol, and a dye,* in the dyeing of acrylic fibers, such as Orlon, Dynel or Acrilan. In contrast to the older method, the cupric salt *does not undergo any reduction* to the cuprous stage. It can be concluded (see example #3) that phenylphenol in itself does not give a satisfactory dyeing effect when the cupric salt is omitted; in this event it acts as a swelling agent only. It appears, therefore, that cupric salt and phenylphenol form a *complex* which is essential to the final effect. The bath is prepared by boiling together dye, cupric salt, and phenylphenol (eg, p-phenylphenol), preferably under superatmospheric pressure and at a concentration higher than that of the subsequent dyebath. This solution is then diluted and dyeing is done as usual. In the preliminary bath, the cupric salt should amount to 50-70% and phenylphenol to 30-60% of the dye's weight. During this first stage, the pH may be observed to decrease; the measurement of the pH value, which has to be established for each individual dyestuff brand, may furnish a convenient test for controlling the dyeing process.

Example: A combination of the dyes Roracyl Dark Green B, Acid Blue 25 (*CI* 62055), and Acid Orange 8 (*CI* 15575) was dissolved in water in the presence of copper sulfate and Purasist RA (p-phenylphenol) and boiled for 20 minutes under pressure of 15 psi. The pH was decreased thereby from 3.4 to 2.6. Continuous filament Orlon was immersed at the atmospheric boiling point in the dyebath and kept therein for 15 minutes. The fibers showed a deep black color. After a one-hour boil, perfect penetration, wash- and lightfastness reportedly resulted.

Among the references cited by the Patent Office:

Belgian Pat 504,492 (Union Carbide & Carbon Corp/1951): dyeing acrylonitrile polymer or copolymer fibers according to the cuprous-ion technique in presence of a carrier of the phenylphenol type. Eighteen examples refer to the cuprous-ion method, but none to the application of nonreduced cupric salts. [Cf also in the parallel USPat 2,743,991 of 1956, reported in *Am Dyestuff Reptr* 45, 781 (1956), col 3, lines 17-35].

Tech Bull (du Pont) 9, No. 1, 15-21 (March 21, 1953) cites various examples in which dyeing of Orlon is done according to the cuprous-ion technique in the presence of phenols.

EMBOSSING AND COLORING FABRICS———Mixtures of Thermosetting and Thermoplastic Used. G,4

USPat 2,802,752 (Apponaug Co——Wood Jr——Aug 13, 1957)

This specification refers to the coloring and embossing of fabrics at the same time. It has been observed that, in standard procedure, colors applied with resin condensates tend to stick and build up on the rolls, making frequent stopping and cleaning necessary.

The chief principle of this invention is the application of new resin mixtures, which are said to permit embossing and/or folding *without the application of heat* so that regular pigment colors and ordinary binders can be used. These resin mixtures are composed of thermosetting resins of the urea-formaldehyde type (3-15%) including a catalyst (1-3%) plus a thermoplastic resin, such as polyvinylalcohol, carboxymethylcellulose, a mixture of water-dispersible vinyl resins and the like (1-10%). A softener (up to 4%) may be added.

A fabric is padded with an aqueous dispersion of this mixture, then tentered to an approximate moisture content of 10% and batched. The resin-prepared goods are passed between a paper bowl (28) and a steel embossing cylinder (29), both kept at room temperature. (See illustration). 28 and 29 have been previously run under pressure in order to impress the raised design from the steel roll to the paper roll. A pigment color dispersed in an aqueous binder is transferred from the trough (35) to steel roll (29); either in simultaneous or in separate operation a color of the same type is applied to the nonembossed portion of the paper bowl from 41 over engraved roll (35) and over transfer rolls (36-38). Thereupon the fabric is cured as usual (31).

Example (for the resin mixture): An aqueous dispersion of 12.5 p vinyl acetate copolymer complex (45-50% conc, such as Aquex BNW); 12.5 p cationic vinyl acetate complex (Aquex BNWC); 60 p urea-formaldehyde syrup 70% (Uscoset 700 L); and 10 p Catalyst AC4 are dispersed in 305 p water.

Among the references cited by the Patent Office:

USPat 2,338,252 (Interchem Corp/1944): a textile decorating composition comprising a pigment dispersed in a mixture of polyvinylalcohol and a urea-formaldehyde condensate.

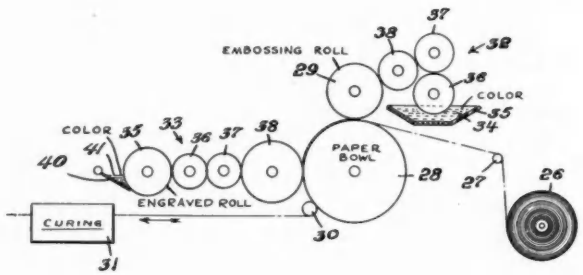
USPat 2,385,714 (Stein Hall & Co/1945): a shrink-resistant finish containing a starch preparation, polyvinylalcohol, and a urea-formaldehyde resin.

USPat 2,653,140 (Canadian Ind Ltd/1953): a textile finishing composition consisting of starch, dimethylolurea and thermoplastic copolymers of unsaturated acids and acid amides. [Cf *Am Dyestuff Reptr* 43, 344 (1954)].

HIGH-TEMPERATURE VAT DYEING———Magnesium Ions Introduced in Hydrosulfite Bath. C,4,02

USPat 2,803,516 (Am Cyanamid Co——Mecco ——Aug 20, 1957)

The preamble to this patent refers to the same inventor's USPats 2,548,-543-4 [cf *Am Dyestuff Reptr* 40, 538 (1951)] and 2,576,846 [*ibid* 41, 307 (1952)]. US Patents 2,548,543-4 protect the addition of inorganic nitrites and halogenates to prevent overreduction of certain vat dyes in high-temperature dyeing, while USPat 2,576,846 describes the addition of organic nitrogen compounds in which N is attached by at least one covalent bond to O and by at least one covalent bond to an element other than N or O. The same compounds were found to improve dyeing results with certain pyranthrone dyes not sensitive to overreduction, according to USPat 2,548,545-6 [cf *Am Dyestuff Reptr* 40, 605 (1951)] and 2,576,847 [*ibid* 41, 307 (1952)]. These



improved results, however, are obtained at the expense of increased hydrosulfite consumption; reduction of the amount of hydrosulfite used in the above-mentioned methods is economically desirable.

It has been observed that the addition of a substantial amount of magnesium ions to the dyebath has the effect of greatly reducing the hydrosulfite quantity. The theoretical reason for this is not known but it appears to be due at least partly to a chemical reaction with the over-reduction buffer. Formation of the Mg salt or complex of hydrosulfite cannot be the only factor because amounts *less than stoichiometrically required* to form such salts or complexes are effective. On the other hand, the magnesium ion must be present in more than catalytical quantities. Useful reactions have been observed when ratios of Mg ion: hydrosulfite (termed as "Mg/hs") within the limits 0.001 up to 0.5 are applied.

Example: A commercial dyeing paste of Vat Blue 6 (*CI* 69825/6), sodium hydroxide, sodium nitrite and a small amount of $MgSO_4.7H_2O$ were added to water in a dye beaker and warmed to 200° F, whereupon hydrosulfite was added. The factor "Mg/hs" was 0.035. After 50 minutes, the bath still contained about 2.2 p hydrosulfite while, under otherwise equal conditions, only 0.7 p hydrosulfite was found when the Mg salt was omitted. Thus, upon standing, the hydrosulfite concentration was much higher when Mg ions were present.

No references are cited by the Patent Office.

WRINKLE-RESISTANT FABRICS————Reaction Product of Acetylene Diurea with Formaldehyde. G,2,04

USPat 2,803,564 (Dan River Mills—Gagarine, Repokis——Aug 20, 1957)

According to the preamble to this specification, it has been commercially impossible to produce satisfactory wrinkle-resistant cotton textiles based on aminoplast finishes *without concomitant chlorine retention.*

The inventors claim to have solved this problem by applying reaction products of acetylene diurea with *excess formaldehyde.* The reaction of acetylene diurea with up to four mols formaldehyde, resulting in the formation of tetramethylolacetylene diurea, is a standard technique (col 1, lines 48-50). Thus "excess formaldehyde" means, in the present case, more than four mols, eg, six-17 mols, while about nine mols are preferred.

Acetylene diurea is prepared from glyoxal and urea in the presence of strong hydrochloric acid. It is first mixed with four mols of 37% aqueous formaldehyde; then eight mols *flake paraformaldehyde* per one mol acetylene diurea and some triethylamine are added to bring the mixture to a pH of about 10. After being heated to 95° C and stirred, the solution gradually becomes clear; it is adjusted to pH 4.3 with hydrochloric acid, forming a water-soluble, syrupy liquid, which is ready for use after storing for 24 hrs at 0° C.

Example: five percent of the above-mentioned syrup, one percent stearamido methylpyridinium nitrate (preparation described in col 4, lines 10-40), and two percent Catalyst AC were made into a solution and applied to a carded gingham cotton fabric. After being air dried and cured for one minute and 20 seconds at 180° C, the fabric reportedly showed satisfactory wrinkle resistance, while no chlorine retention could be noted.

References cited by the Patent Office:

French Pat 858,233 (I G Farben/ 1940) describes condensation af acetylene diurea (or derivatives thereof) with formaldehyde under neutral or alkaline conditions and reduced pressure to obtain an adhesive. (Patent misquoted in the specification).

French Pat 885,927 (I G Farben/ 1943): acetylene diurea treated with formaldehyde in the presence of alkaline agents, such as $Ca(OH)_2$, to transform it into the water-soluble methylol derivative.

Copending USPat 2,724,664 protects the treatment of cellulosic textiles with an aqueous solution of a resin-forming methylol acetylene diurea using a quaternary ammonium compound, such as stearamido methyl pyridinium chloride, as a catalyst.

Abstracts

The Application of Resin Finishes to Cotton Garments Using Drycleaning Plant Equipment

Graham, R T, Loibl, F, and Wiebush, J R, *Textile Research J* **28**, 252-6, March, 1958

The National Institute of Drycleaning has been studying the feasibility of application of crease-retentive, wrinkle-resistant finishes to cotton fabrics and garments. The ultimate objective of the work reported in this paper is to impart wrinkle resistance and desirable permanent creases to finished cotton garments by the use of conventional drycleaning plant equipment.

The approach to this work has been to determine what conditions produce the optimum finish on a particular fabric construction within the rather rigid limits of curing imposed by the conventional equipment used by drycleaners.

The resin formulation chosen for study consisted of a water solution of the following components: thermosetting resin, cyclic ethylene urea type, 50% solids (Rhonite R-1), thermoplastic resin, acrylic type, 35% solids (Rhoplex S-1), silicone emulsion, 40% solids (DeCetex 104 emulsion), metal salt-type catalyst, 35% solids (Rohm & Haas Catalyst H-7), catalyst for silicone resins (Dow-Corning Catalyst XEY-21), and nonionic surface-active agent (Triton X-155).

The fabric (80 x 80 cotton print cloth) was saturated with this solution, extracted to 75% wet pickup, dried and cured on a hot-head press in a single operation at 300°F, after-cured in a hot-air cabinet at 175°F for one or more hours, and washed and tumble-dried at 150°F. All operations were performed in standard drycleaning equipment.

The same resin treatment was applied to other types of cotton material: cord, denim, sateen, broadcloth, gingham, corduroy, and light and heavy weight suitings. Most of these fabrics required a longer time for drying and curing.

Following the resin treatment, all samples were washed ten times at 140°F with a commercial detergent. Generally speaking, the various fabrics withstood the washings very well.

Treated samples of the various fabrics were also subjected to repeated commercial drycleanings; all withstood the cleaning action very well.

The authors give some figures concerning the cost of this treatment.

Investigations into the Dyeing of Continuous-filament Nylon with Disperse and Anionic Dyes

Peters, H W and Turner, J C, *J Soc Dyers Col* **74**, 252-81, April, 1958

Outstanding among the factors which determine the use of a particular dye on a particular fiber is the ability of the dye both to color the goods uniformly and to provide adequate fastness for the proposed end-use. These requirements are not always reconcilable on continuous-filament nylon, whether as yarn or as fabric. This paper endeavors to explain the underlying difficulties, to describe the behavior of the various dye classes on nylon, and to suggest directions in which progress in the wider application of faster dyes may most readily be made.

At the present time the greater proportion of continuous-filament nylon, according to the authors, is dyed with disperse dyes, because of their ability to cover variations in the nylon yarn. However, due to the poor washfastness of the disperse dyes, there is an increasing demand for faster dyes.

The nature of the variations in continuous-filament nylon (ie, variations in physical structure and in amine end-group content) and their influence on dyeing behavior are explained. By the use of a special fabric containing yarn differing in physical and chemical properties by known and controlled amounts, the sensitivities to such variations of many dyes for nylon have been assessed. These results appear in an appendix in tabular form, and are intended to help the dyer to select suitable dyes, by indicating their abilities to cover yarn irregularities. The dyestuffs listed in these tables, numbering well over 1000, include metal-complex, chrome, acid and azoic dyes, offered by British, American, German and Swiss firms.

New and current dyeing methods are discussed, and suggestions are made for improved uniformity. Laboratory investigations have shown which new methods offer most prospects of success, and also where more detailed investigations will be of value.

In particular, the authors stress the importance of high-temperature dyeing, and state that the most promising techniques for the application of "fast" dyes to woven fabrics are probably those based on a preliminary padding of cloth, followed by a fixation stage. They believe that further investigation is necessary to establish optimum conditions.

The Dyeing Behavoir of Acrylic Fibers

Edwards, H D, *Man-made Textiles* **34**, 66, 68, Jan, 1958

Although the acrylic fibers were first established in the knitted outerwear market, their application is being rapidly extended into a far wider range of apparel and other end-uses, where the desirable features of the acrylic class of fibers (resilience, bulk and washability) can be exploited. These properties are found in most of the acrylic fibers, the principal differences in behavior between the fibers being in their reaction to wet processing (eg, shrinkage, extensibility and elastic recovery).

The writer refers to the relative ease of dyeing the acrylics in a complete shade range, but states that the thermoplastic nature of these fibers "provides a particular challenge to the dyer, since it is in his own field of endeavor that this property of acrylic fibers becomes all-important and that the differences between the different types of fiber are sharply revealed."

Most of the commercially available acrylic fibers consist essentially of acrylonitrile polymer together with certain additions which confer among other properties that of dyeability. Two main classes exist, those fibers which dye with acid dyes and those which dye with basic dyes.

The discovery that basic dyes have improved lightfastness on acrylic fibers has stimulated research into new types of basic dyes, some of which have lightfastness of a very high order. The author anticipates that this research will lead to still further improvements. He warns, however, that not all of the basic dyes give the expected good lightfastness when used in combinations.

In order to achieve dyeability with acid dyes it is necessary to introduce basic groups into the polyacrylonitrile polymer, and this must be achieved without undue effect on the general stability of the fiber. While the full range of acid dyes is thus made available, it is found that many of them do not give the fastness properties anticipated from their behavior on the older fibers.

The acrylics may also be dyed with disperse dyes in pale to medium shades of good general fastness.

The author discusses the various types of machines used in dyeing these fibers in the form of slubbing, tow, yarn, and piece-goods. He states that piece-dyeing is probably the most critical form of dyeing, in that the fabric in final form is exposed to distortion effects which may completely ruin the appearance if they persist after the final processing. He recommends, among other things, slow cooling after dyeing to avoid setting creases into the fabric.

Textured Yarns—One of the Fastest-growing Textiles

Blore, J H, *Textile World* **108**, 60-2, May, 1958

Textured yarns are continuous-filament yarns that have been modified so that the filaments do not lie parallel to each other. Fabrics made from these yarns have more cover, and they are softer than fabrics made from untreated filament yarns.

Stretch yarns, also modified continuous-filament yarns, are classed as textured yarns. Some textured yarns, however, do not stretch.

High-bulk yarns are spun yarns made by blending high-shrinkage staple fibers with low-shrinkage staple fibers. They are not textured yarns because they are made from staple fiber rather than continuous filaments.

The author points out that the object of carding, drawing, and combing operations in a textile mill is to make a mass of fibers lie parallel or more parallel. The object of texturing, by contrast, is to take a mass of parallel fibers and make them lie less parallel.

Another object of texturing is to produce a yarn with the characteristics of a spun yarn. These characteristics include absorbency, soft hand, opaqueness, warmth and cover—properties most desired in many textile materials. The new textured yarns have some of the advantages of spun yarns, some of the advantages of filament yarns, and some added properties such as resilience.

Most textured yarns are now being used in carpets, where the properties of resilience, strength, cover and evenness are important. The market for sweaters made of textured yarns is growing by leaps and bounds, according to the author. Other end uses for these yarns are in draperies, upholstery, socks, gloves, swimsuits and bedspreads.

The author describes some of the methods of producing textured yarns, and lists 15 different varieties by name. Nylon and Dacron appear to be the principal fibers textured so far, but rayon and acetate fibers are increasing in importance because of their low cost. Even glass fibers are being textured for better draperies.

Solution-dyed yarns are being textured in increasing quantities to overcome some of the difficulties encountered in dyeing.

At the present time, prices of textured yarns are higher than spun yarns of comparable size.

News of the Trade

U S Testing Introduces W&W Verification Plan; Du Pont Announces Test Methods

A new plan for verification of "wash and wear" fabrics and a unique evaluation procedure was announced last month by the United States Testing Co prior to an announcement by E I duPont de Nemours & Co, Inc's Textile Fibers Department that it had developed scientifically reproducible test methods "to determine wash and wear properties of fabrics and garments".

The announcements preceded the introduction of a tentative test proposal on wash-wear appearance by AATCC's Committee on Wash and Wear on May 23rd. AATCC's method has been submitted by letter ballot to its Technical Committee on Research.

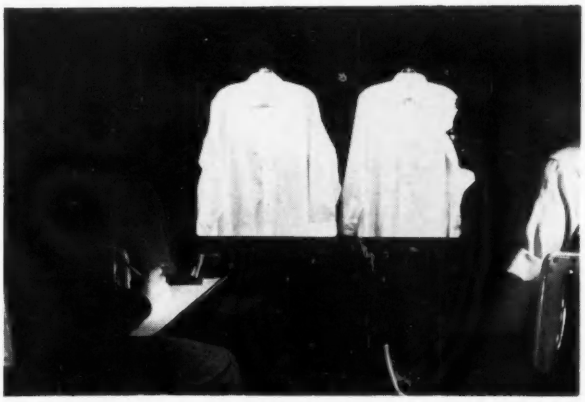
U S Testing Co announced its new verification plan and standards prior to a W&W Symposium of the AATT at the Hotel Vanderbilt, New York. Keystone of the standards is a standardized viewing apparatus, adopted from the graphic arts field, and an objective procedure based upon the science of psychometrics. The final result is said to be a reliable system for evaluating the appearance of any fabric or garment under test. Other properties, such as colorfastness, shrinkage and strength are included in the program of tests. The verification program applies these realistic standards to textile products bearing Wash & Wear claims.

Research studies over the past few months indicate a shift of purchasing patterns, dissatisfaction with many present wash & wear descriptions and claims, but not as yet an active counter movement. It was revealed that the "drip dry" concept is not understood. Similarly, the home washing machines and dryers play a much bigger role in the whole subject of wash & wear than is generally appreciated.

H M Block, US Testing Company vice president said, "The United States Testing Company cannot go into the background of why 'wash & wear' has become controversial, ambiguous and vague—however, the United States Testing Company must be concerned about the consequences both to the industry and to the consumer, if this condition is to be allowed to continue."

Mr Block went on to say that what is needed is a classification of terms, definition of standards and then identification by an impartial agency of those brands and products which meet, and continue to meet, valid standards. To this end US Testing Company has proposed a system of voluntary policing for the industry to accomplish a dual objective:

1) *Educational* — The consumer should be informed of the convenience properties built into the fabric or garment she buys and of the correct methods for laundering. She will then know how to handle, care for and enjoy the product she has purchased.
2) *Manufacturing Control* — The producer will have a continuing source of impartial information, covering the wash & wear properties of his product.



PSYCHOMETRIC EVALUATION AT US TESTING COMPANY— An illustration of the method of Paired Comparison under standardized illumination and viewing conditions.

Dean Foster, director of laboratories of US Testing Co, reported, "We have developed a program for wash & wear that encompasses the two fields—that which is truly washable and wearable, requiring no ironing, and that which is washable and wearable, with some further attention. Here we have followed the accepted terminology of wash and wear with minimum care."

"*Verification* has been adopted by United States Testing Company as its descriptive term for both these classes:

One—Verified Wash & Wear, No Ironing, United States Testing Company standards

The Other—Verified Wash & Wear with Minimum Care, United States Testing Company standards

"Here is how the program will be administered:

1) All manufacturers, producers, cutters, dyers and finishers, or others are invited to submit their wash & wear products for impartial evaluation against United States Testing Company standards.

2) If qualified, the product can immediately become part of the United States Testing Company *Verified Group*, and will thereafter be subject to subsequent monthly repeat evaluation, based on samples impartially obtained by the United States Testing Company in the open market. A simple form of agreement will describe the plan and will be offered each firm submitting fabrics or garments.

3) If not qualified, the deficiencies will be reported back to the manufacturer as an aid to correcting the defects and then the product may be resubmitted.

4) The cost for the program will be kept to a minimum. This is to be a cooperative effort with the textile industry. There will be no fee for qualification testing and an annual retainer for the continuing Verification."

Dr Foster continued "It is not anticipated that in 1958 any large number of sumbittals will qualify; perhaps only one out of ten will meet all criteria, but it is expected that as manufacturers improve their products, more and more will be eligible for the verification program. We believe that this is the type of program that will benefit all.

In the meantime, the consumer will *not* be losing confidence in wash & wear claims; any possible control by outside agencies will be removed and manufacturers will sell their products

with full assurance that they will perform exactly as described. This is the kind of program that is good for manufacturer, retailer and consumer.

The appliance manufacturer will benefit too, as the US Testing Company will coordinate its research effort with theirs."

DuPont's procedures, which are being made available to the textile industry in a technical information bulletin, include preparation of sample fabrics or garments, controlled methods for wear testing, washing, drying, and evaluation.

The DuPont tests were described as "intended to provide the laboratory, through both wear testing and controlled washing and drying tests, with the means of evaluating test samples and garments." The tests do not yet represent a technically controlled "system" for arriving at the degree of performance satisfaction that a consumer will obtain from a given garment in a particular end use.

Evaluation covers five major factors in wash and wear performance: wash crease retention, wash wrinkling, wear crease retention, wear wrinkling, and seam puckering, fraying, or failure.

In evaluation, the material tested is hung flat on a white board under controlled lighting, evaluated by three trained persons, and assigned a numerical rating with regard to the property being evaluated. Under the rating system, the number five refers to perfect performance, the number one to poor performance. The number is assigned on the basis of comparison with an arbitrary standard, regardless of the intended end use of the test item. Further work to correlate these laboratory methods with actual performance will be required before this rating system can be used to predict performance satisfaction for each particular end use.

Equipment required is simple and easily installed. It includes: an agitator-type washing machine with controlled water temperature settings, approximately 60 agitator cycles per minute, and a final spin cycle time of four to six minutes with final spinning speed in the range of 500 to 600 revolutions per minute; an automatic tumble drier which has a setting with maximum temperature of 160°F, and a five- to 10-minute cool tumbling period at the end of the drying cycle; provision for hand washing, drip drying, and hand ironing areas; and an evaluation area with controlled lighting furnished by a four-foot, two-bulb, white fluorescent lighting fixture.

Detailed instructions for testing, ranging from sample preparation to avoid nonrepresentative results due to presence of finishing agents, through carefully controlled wear and wash testing, to final evaluation, are contained in Technical Information Bulletin X-83, available from the technical service section of Du Pont's Textile Fibers Department.

VDI Elects Officers, Launches New Ad Series

H J Daigneault of National Aniline Division, Allied Chemical Corp, has been elected president of The Vat Dye Institute, Inc.

Other new officers named at the board of director's second annual meeting last month are: J C Walker, Toms River-Cincinnati Chemical Corp, senior vice president; T C Keeling, Koppers Co, Inc, vice president; J R Bonnar, General Dyestuff Co, treasurer; H F Herrman, executive secretary; and E S Meyers, Laporte & Meyers, counsel.

Newly elected members of the board of directors include Mr Daigneault; E R Herbertson, Arnold Hoffman & Co Inc; J L Naylor, American Cyanamid Co; D C Newman, E I duPont de Nemours & Co, Inc; and H L Urban, Verona-Pharma Chemical Corp.

The Institute also announced the appointment of standing promotion, finance and technical committees. The promotion committee, headed by Mr Naylor as chairman, includes Mr Walker; W Kieffer, Ciba Co, Inc; and S H Williams, General Dyestuff Co. Mr Bonnar is chairman of the finance committee. The technical committee consists of W A Holst, National Aniline Div, Allied Chemical Corp, chairman, and C A Sylvester, E I du Pont de Nemours & Co, Inc.

* * *

Leading company executives in the textile industry are enlisting their support to accent the important values of vat colors for apparel and home furnishing fabrics through the 1958 national promotion program launched by the Institute.

Initial cooperative effort of the executives, including presidents of textile mills, dyeing and finishing plants and thread manufacturers, is in a unique series of national trade publication advertisements. A different personality is featured in each ad with a photograph and quote, stressing why he believes vat color standards to be in the best interest of the trade and consumer and why his organization approves and uses vat dyes.

Among those included in the program are Marvin R Cross, president of Greenwood Mills, Inc, Ernest Chornyei, president of Bradford Dyeing Assoc, W J Erwin, president of Dan River Mills, Inc, P S Howe Jr, president of American Thread Co, W R MacIntyre, president of Joseph Bancroft & Sons, Herbert Ruhm, president of Wellington Sears Co, and others.

The "leadership" series is part of the Institute's quarter-million dollar educational drive to highlight the practical advantages of vat colors for textiles. It is designed to reach every level of the textile industry from mill executives, finishers and cutters to retail stores and customers throughout the nation.

Other aspects of the program include national advertising in leading consumer publications coordinated with a continuing schedule of retail store promotion and merchandising activities geared to special seasonal events; a carefully planned direct mail campaign; development of sales promotional material; and a strong public relations and publicity plan on both consumer and industry-wide levels, to tie in with the promotion calendar.

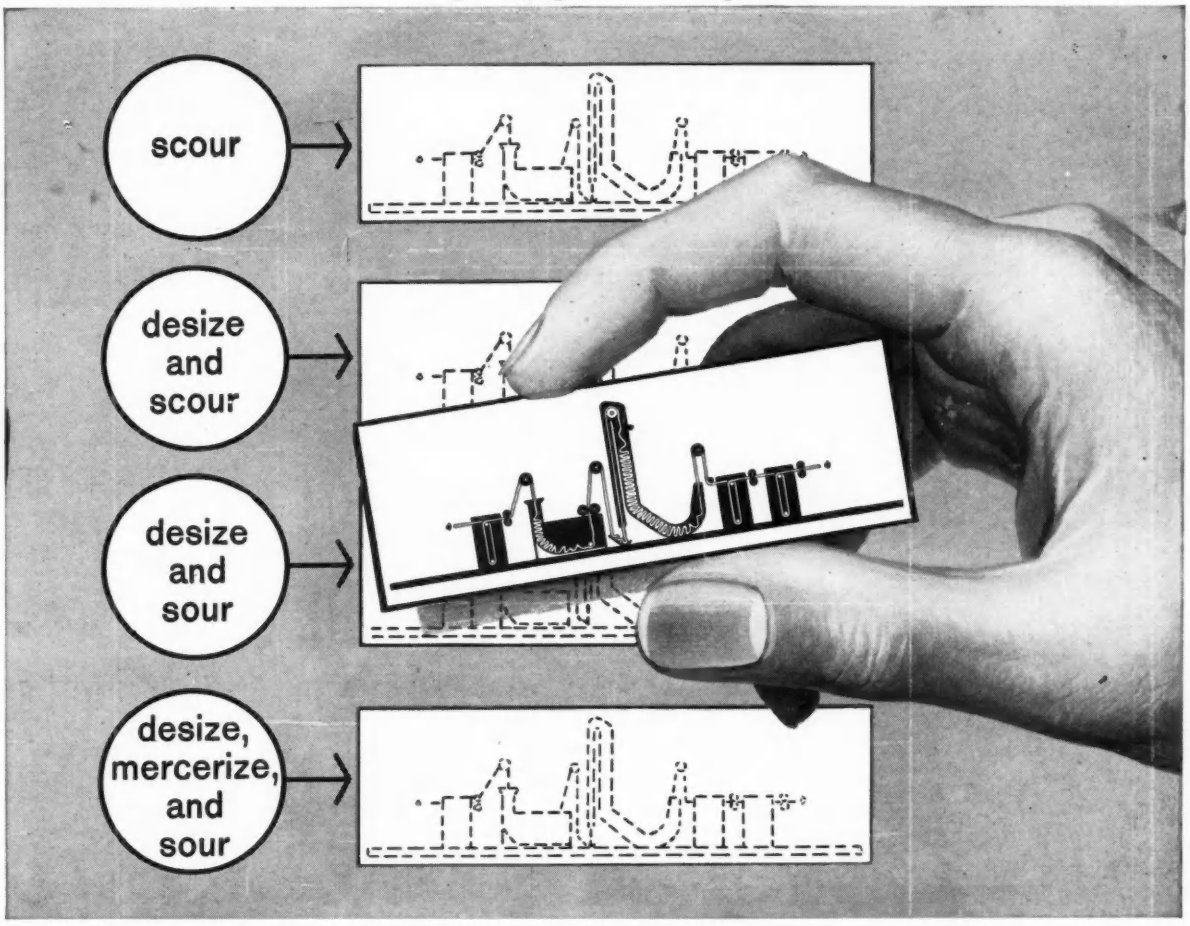
Personal contact with textile industry leaders is intended to promote broader identification of vat colors in finished textile products, including store tags and labels, and cooperation of important sales, designer, advertising and promotion personnel. Firms included are colored yard and thread mills, integrated mills with their own plain dyeing or printing equipment and commission print works and finishing plants.

According to Henry Herrmann, executive secretary of the Vat Dye Institute, the main purpose of the expanded promotion program is to impress textile mill and converting people, manufacturers, retailers and consumers with the definite superiority of vat dyes in colored cotton, viscose rayon and linen ready-to-wear soft goods and home furnishing fabrics. "We are interested in demonstrating the actual economy of fabrics colored with vat dyes," he said, "and to combat any tendency of subordinating color quality in favor of lower cost. This information should be of particular value to the general public which mostly has only a hazy concept of what vat dyes are."

Mr Herrmann added that the "vat story" is of chief significance in the growing wash-and-wear market, since true color fastness is basic to the washability of any fabric.

Further information on vat dyes and the new program is available from Vat Dye Institute, Inc, Empire State Building, 350 Fifth Avenue, New York 1, New York.

Fits in with any type of pre-treatment...

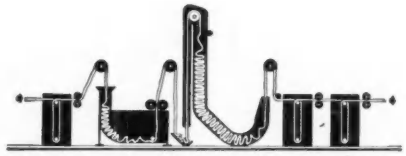


DU PONT **SOLO-MATIC** PROCESS

is flexible, cuts costs

• No matter what type of standard pre-treatment you use, the Du Pont Solo-Matic hydrogen peroxide bleaching process can work with it. And the Solo-Matic process is equally flexible in another way—it can be adapted to any type of continuous bleaching range!

Savings are a key item, too. Du Pont's Solo-Matic process has the same capacity as multi-stage bleaching systems... yet saves up to 40% on capital investment and operating costs. This advanced single-stage system assures high uniform brightness with a minimum of equipment! For more details, write Du Pont at the address below.



DU PONT'S SOLO-MATIC PROCESS—the most advanced single-stage bleaching method available.

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***Offers for* WOOL–COTTON**
SYNTHETIC and MIXED FIBERS
a complete line of
ANILINE and ALIZARINE COLORS

ANTHRANOL Chrome colors for wool.

METAMINE Acid colors for wool.

MILLING FAST Neutral or weak acid dyeing colors for wool of good fastness to light and fulling.

NYAGENE Developed colors for cotton, rayon and other vegetable fibers.

NYALITE Direct colors for vegetable fibers of superior light fastness.

NYANCET Dyestuffs for acetate silk or celanese and Nylon.

NYANTHRENE Vat colors for cotton and rayon.

NYANZA Direct colors for the dyeing of vegetable fibers.

NYAPERM Direct colors for vegetable fibers which when aftertreated with Nya-Permol render shades of vat color fastness.

NYASOL Metallized colors for wool characterized by exceptional fastness properties.

NYANZOL Oxidation colors for the dyeing of fur skins.

NUTRACHROME Colors for wool applied by the Metachrome process yielding shades of excellent all-around fastness.

PARANOL FAST Direct colors for vegetable fibers of excellent light fastness.

VEGAN Union colors for the dyeing of mixed fibers of cotton and wool yielding solid shades of good fastness.

TEXTILE CHEMICALS

IMMERSOL Synthetic wetting-out and levelling agents in the dyeing of cotton and wool.

LANALBINE Protective agent in the dyeing of wool, silk and other animal fibers.

MELLOSTRINE Water-proofing compound for the treatment of cotton, rayon and other vegetable fibers.

NUTROSAN Synthetic detergents for the scouring of wool.

NYAPON Synthetic detergents of sulfonated fatty alcohols.

• *call or write for technical data or information:*

NYANZA **Color & Chemical Company, Inc.**

109 WORTH STREET • NEW YORK 13, N. Y.

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304 E. Morehead St. CHARLOTTE 3, N. C.

A group of advisers of the Cotton Chemical Laboratory of the Southern Utilization Research and Development Division of the Agricultural Research Service, USDA, discuss current research with F S Perkerson, chief of the laboratory. In the group, l to r, are: Dr Perkerson; Leonard Smith, director of utilization research, National Cotton Council of America; Harley Y Jennings, director of research, Dan River Mills, Inc; and J C Barnes, head of the laboratory, Kendall Mills. Members of the staff reported on progress in various research projects, such as "wash and wear" cotton fabrics, and preparation of cotton fabrics resistant to water and oil. Advisory groups such as this afford the research staff the advantage of recommendations of industry leaders on research problems, and help in the planning of needed research for the future.

Cyanamid Reduces Aerosol Prices

American Cyanamid Company announced last month that it has reduced prices on all grades of Aerosol® surface-active agents.

The price cut on Aerosol OT-75 percent, one of the first and most widely used synthetic surface-active agents, is $.23 a pound. The new price is $.45 a pound in minimum quantities and $.35 a pound in tank wagon quantities. Reductions in other grades of surface-active agents range from $.40 to $.02 a pound.

The Company indicated that the price reductions coincide with Cyanamid plans for expanding facilities for the production of surface-active agents at its Bridgeville, Pa plant.

Nopco Honors Veteran Employees

Nopco Chemical Company feted forty employees, who have joined the company's 15-25 Year Club, at the Hotel Robert Treat in Newark, NJ on May 20th. The employees received awards for their service records from Ralph Wechsler, company president.

Twenty club members, each having worked at Nopco for 25 years, were given a choice of photographic equipment, silver, or the traditional gold watch. The 15-year veterans received gold pins and are now entitled to three vacation weeks instead of two.

The new members bring the total enrollment of the 15-25 Year Club to 250 or 26% of total Nopco personnel.

Collection of Rare Textile Engravings

J H Villard, Inc, has assembled a collection of rare engravings showing the progression of the textile weaving, dyeing and finishing operations from the 16th to the 19th century.

Also included in the collection is a complete set devoted to the history of textile printing from wood block to copper plate; a set covering the development of the hosiery industry, early knitting and finishing machines, needle manufacture; a set on the development of textile machinery and equipment; and a set devoted to the processing of natural fibers and dyes, eg, cochineal, indigo, saffrin, by European and Oriental (Chinese, Indian) methods.

These may be seen by appointment. Contact J H Villard, Inc, 175 Fifth Ave, New York 10, NY. Phone: ORegon 3-7340.

Colton Lowers Prices on Flexbond Copolymer Emulsions and Beads

Colton Chemical Co, a division of Air Reduction Co, Inc, has announced reductions in the prices of Flexbond vinyl acetate-vinyl stearate copolymer emulsions and beads now on stream. These price reductions, to take effect immediately, range from 18% to 33%. They apply to nine grades that heretofore have been available in pilot-plant quantities only.

The film properties of vinyl acetate-vinyl stearate copolymer emulsions reportedly exhibit such desirable characteristics as grease and water resistance, nontoxicity, permanent flexibility, heat sealability, excellent adhesion and transparency.

Vinyl acetate-vinyl stearate copolymer beads are said to be soluble in benzene, toluene, methyl acetate, carbon tetrachloride and other common solvents. The lower stearate content beads reportedly tolerate significant quantities of the lower alcohols.

For technical data and complete prices, write Colton Chemical Company, 1747 Chester Avenue, Cleveland 14, Ohio.

L&N Breaks Ground for New Research Center

Ground-breaking for a new scientific research center was linked today to President Eisenhower's speech on business conditions, by I Melville Stein, president of Leeds & Northrup Co. Stein initiated the excavating May 27 at a brief ceremony on the electronic-controls manufacturer's property near North Wales, Pa.

"As an aid to general business recovery," said Stein. "Mr Eisenhower advocated not holding back on investments in plants and equipment. We are pleased that this $1.7 million project can be timed to fit in with the views he expressed. Furthermore, we feel that business can get excellent value for its new-facility dollars if it has the courage to go ahead at the present time."

"Mr Eisenhower referred, in addition, to the need for more production and more jobs. Specifically, all production at L&N, and every job in our organization, is importantly influenced by our scientific research. More broadly, research from centers like this helps industry to make better consumer products, thus helping to provide more jobs in the whole economy. It is research which makes ours a growth industry."

The building, of 65,000 square feet, is scheduled for completion next spring.

P & F Executive Offices Relocated

The executive offices of Penick and Ford, Ltd, Inc, corn refiners, are now located at 750 Third Avenue, New York 17, NY. The new telephone number is YUkon 6-4700. The newly erected building occupies the block between 46th and 47th Street.

Geigy's First 200 Years

This year, the international chemical firm of Geigy celebrates its 200th year in the dyestuff industry. For two full centuries, Geigy has been either a purveyor of raw materials used for making dyes, or the actual manufacturer of dyestuffs for the textile, paper and leather trades. Thus Geigy joins the very exclusive ranks of enterprises that have existed under the same name for two hundred years.

Next year, Geigy reaches another important milestone—its 100th year as a manufacturer of synthetic dyestuffs. It was just three years after William Henry Perkin synthesized mauveine, thereby launching a new era for the dyestuff industry, that Geigy scientists in Basle, Switzerland, the company's world headquarters, successfully produced their own synthetic dyes.

Home of the founder of the international chemical firm of Geigy—Basle, Switzerland

Since that momentous occasion in 1856, some 30,000 synthetic dyes alone have been created. Hundreds of these were created by Geigy's research scientists. Geigy's second century of activity, in fact, was marked by a number of noteworthy achievements in dyestuff development, as well as in other chemical fields such as pharmaceuticals, industrial and agricultural chemicals—of which its greatest accomplishment was originating DDT insecticides.

The worldwide chemical company had a humble beginning in 1758, in the venerable town of Basle, Switzerland where a young merchant, Johann Rudolph Geigy opened a trading house to deal in coloring materials such as indigo, blue and yellow dyewoods and quinine bark; sudorific herbs, purgatives, and other medicinal substances; coffee, pepper, nutmeg and other spices.

Shortly afterward, young Geigy joined forces with an apothecary and started a line of pharmaceuticals. The market for dyestuffs was growing apace, while the demand for medicinals was comparatively meager, so the firm concentrated on dyestuffs and other materials more in demand.

In 1830, Carl Geigy, the founder's grandson, decided to shift from being strictly a trader in raw materials to an actual producer of dyeing powders, so he built a mill in Basle, where imported dyewoods were pulverized and sold to the textile trade.

By 1856, the company had grown successfully, and Geigy converted from this primitive operation to a steam plant for improved and expanded production. By this time Johann Rudolph Geigy, a fourth generation descendant of the founder, was the firm's head. In that same momentous year, William H Perkin revolutionized the dyestuff industry when he synthesized the first coal tar dye, mauveine. Three years later, Geigy's scientists, prodded by the head of the company who envisioned a great future for dyestuffs, snythesized their first dye.

Geigy financed the construction of a plant to produce the so-called aniline dyes for a former associate, J J Muller. Muller earned one of the highest awards of merit for his synthetic dyes at the London Exhibition. One of Muller's creations was known as "Vert Usebe", a color which became fashionable at the court of Empress Eugenie of France. Pleased with the results of Muller's work, Geigy absorbed the factory into its operations.

Geigy started building up a staff of chemists for a newly created research division, in the 1880's being well aware of the fact that the company's prestige depended greatly on their ability to create new coloring materials. His wisdom paid off, for the first Geigy-created dyes were patented within a year or two after Muller joined forces with him. Geigy's full-fledged emergence as a significant factor in the dyestuffs field came in 1888, when Traugott Sandmeyer was engaged to head its scientific research division. He produced a long line of new dyestuffs, including indigo, which firmly established the Geigy firm as one of the most important in the highly specialized field in Europe.

As the firm expanded production, Geigy sought new markets and built new plants in Russia, France and Germany. Sales offices were established in such far-apart places as India and New York, Boston, Philadelphia and Toronto.

In 1901, the firm became a stock company, and in 1914 it adopted the name of J R Geigy SA, by which the parent company is still known. The first Geigy company in the US was formed in 1903. Up to World War I, the company merely imported and sold dyestuffs produced by the parent company in Switzerland. During World War I, and afterward, when supplies were cut from Switzerland, Geigy acquired production facilities in the United States, and eventually founded new subsidiary companies in England and started operations in Italy.

Following World War I, Geigy became associated with the Cincinnati Chemical Works, in Ohio, which has been expanded to Tom's River, NJ, and is known as Tom's River-Cincinnati Chemical Corporation.

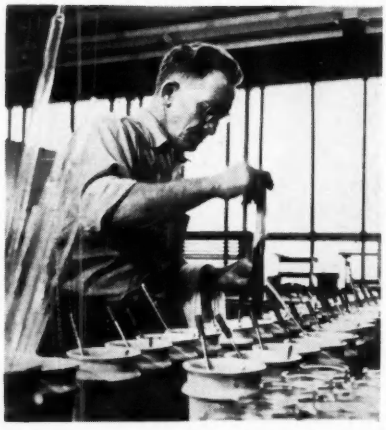
Outstanding contributions of the company in the textile field are highlighted by the Irgalans, a line of neutral fast-drawing dyestuffs; the Tinopal optical brightening agents; the Maxilon series of dyes for Orlon acrylic fiber; and Mitin durable mothproofing agent, technically, the coal-tar derivative di-chloro-diphenyl ether dichloro-phenyl urea.

As the new "synthetic" or man-made fibers have been introduced, Geigy researchers have developed dyes specifically engineered for them.

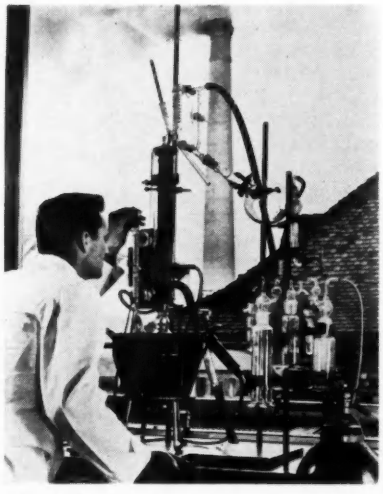
Geigy is also a major factor in the production of vat dyes, as well as a producer of numerous textile auxiliaries, which are designed to improve dyeing and other wet-processing operations.

Thanks to its work with DDT insecticides the company became established as a major factor in the production of pesticides. Its plant in

Typical laboratory section at Ardsley containing complete equipment and apparatus for chemical research and testing.



At Geigy's new Dyestuff Research Laboratory in Ardsley, NY, a research worker is shown dyeing strands of woolen yarn with a new material to ascertain its drawing ability to attain the desired shade. Other laboratory tests will determine the dyestuff's fastness to light, washing, etc.



Chemical analysis apparatus at Ardsley.

McIntosh, Alabama, is one of the largest American producers of DDT, and other agricultural chemical specialties. The Pharmaceutical Division was formed in 1947, to reach the medical profession with new drugs coming out of Geigy laboratories.

In 1948, Geigy acquired the Alrose Chemical Company, and created the Industrial Chemicals Division. This division has a plant in Cranston, RI, where they make auxilary products for the textile, soap, and cosmetic industries. Geigy's most recent expansion has been in the textile pigment printing field and is presently manufacturing these popular products in the Cranston plant.

Until the summer of 1956, the headquarters of the American Geigy Company had always been in New York, NY. Then the company moved to a specially built complex of ultra-modern buildings at Ardsley, NY, 20 miles north of Grand Central Station. One of the most interesting features of this new plant is the magnificent laboratory conducted by the Dyestuffs Division.

Geigy also maintains a warehouse and mixing plant at Bayonne, NJ.

Today, the Geigy organization includes more than forty separate companies, all operating as subsidiaries of the parent company, J R Geigy SA, Basle, Switzerland. Geigy offices, plants and subsidiaries are located in every major country of the world. The US company, Geigy Chemical Corporation, with its four divisions, has branch offices and laboratories in Charlotte, NC, Chattanooga, Tenn, Chicago, Ill, Los Angeles, Calif, Newton Upper Falls, Mass, Philadelphia, Pa, and Portland, Ore. There's also a Canadian branch office in New Toronto, Ont, Canada.

Hooker and Shea Stockholders Vote to Consolidate

Shareholders of Hooker Electrochemical Co, Niagara Falls, NY, and Shea Chemical Corp, Boston, Mass, voted overwhelmingly last month in separate meetings to consolidate Shea Chemical with and into Hooker and at the same time adopt the name Hooker Chemical Corp for the consolidated continuing company. The stockholders' action was formally effected May 29.

Vincent H Shea, formerly president of Shea Chemical, now joins the twelve former Hooker Electrochemical directors on the board of Hooker Chemical Corp.

The new company name more accurately represents Hooker's wide varitety of chemicals and chemically made plastics, no longer limited to products of electrochemical manufacture.

The phosphorus compounds manufactured by Shea broaden the range of the organic and inorganic chemicals, synthetic resins, and plastic molding compounds produced by the corporation. Shea's plants produce sodium tripolyphosphate, dicalcium phosphate, phosphoric acid, tetrasodium pyrophosphate, ferrophosphorus and a number of other phosphorus compounds, none produced by Hooker heretofore. Shea's basic production of phosphorus will provide a low-cost source for Hooker's other phosphorus compounds.

Sodium tripolyphosphate, Shea's most important product representing about 75 percent of its sales, is used by soap manufacturers for the manufacture of synthetic detergents. Shea's production capacity reportedly represents about 18 to 20 percent of the nation-wide capacity.

Dicalcium phosphate is Shea's second largest volume product, reportedly constituting about 45 percent of the total national consumption. Phosphoric acid constitutes about eight percent of Shea's sales.

Hooker produces over 100 chemical products from its six basic chemicals, chlorine, caustic soda, caustic potash, sodium chlorate, phenol and hydrogen. With the acquisition of Oldbury Electro-Chemical Company in 1956, Hooker entered the field of phosphorus and phosphorus compounds now expanded by the Shea line of products.

Shea's plants are located at Columbia, Tenn; Dallas, Texas; Jeffersonville, Ind; and Adams, Mass.

Hooker's net sales for 1957 were reported at $107,868,000 while Shea's 1957 sales amounted to $20,555,000. Total employees now number more than 4,750, including the 560 Shea employees.

• NAMES IN THE NEWS •

Swenson

Hal M Swenson has been appointed Central South sales representative for the Kelco Company. He will handle the sales of Dariloid, Sherbelizer, Kelcoloid, Kelgin, and other Kelco algins.

Swenson, who will make his home in New Orleans, was formerly sales representative for a scientific instruments firm for the Louisiana-Mississippi area.

Great Barrington Mfg Co has announced the appointment of **A Durfee Damon**, formerly general manager of Dutchess Bleachery, Wappingers Falls, NY, as industrial fabric finishing manager. Mr Damon has assumed his duties and will be responsible for all Industrial Fabrics finished at Great Barrington.

Charles H Reynolds, vice president of Spindale Mills, Spindale, NC, and a member of the State Board of Higher Education, was presented the "Man of the Year" Award by the North Carolina State College Chapter of Phi Psi, national honorary textile fraternity, on May 22.

The award was presented during the society's annual banquet.

Williamson

The assignment of **J B Williamson** to the Atlanta office of Ciba Co Inc will further consolidate the staff of the Ciba dye sales and service center for the Georgia, Alabama and Tennessee areas.

Lewis Darden will assist Mr Williamson on all laboratory work at Atlanta.

Shutts

Roth

Food Machinery and Chemical Corp has named **C Bryon Richards** director of industrial relations for its Chemical Divisions. For the past two years, Mr Richards has served as industrial relations manager at FMC's largest chemical installation, the South Charleston, W Va plant of the Westvaco Chlor-Alkali Division.

Albert P Shutts, assistant sales manager since January 1957, has been promoted to sales manager of FMC's Becco Chemical Division.

Succeeding Mr Shutts as assistant sales manager is **John R Hopkins**, formerly technical assistant to the sales manager. He will have charge of the division's advertising and publicity, as well as assisting Mr Shutts in the supervision of field sales activities.

Edward M Roth Jr has been named manager of Becco's Upper New York sales territory with headquarters at Becco's main plant in Tonawanda, NY. He was formerly assistant manager of the New York-Philadelphia sales territory, and has worked the Upper New York territory previously.

James Day, Dow Chemical Co, has been named general chairman of the annual meeting of the Drug, Chemical & Allied Trades Section of the New York Board of Trade, by **W Boyd O'Connor**, chairman of the Section.

The three-day DCAT meeting will be held Sept 11-14 at the Sagamore Hotel, Bolton Landing, Lake George, NY.

Edwin J Grajeck, former assistant director of research for Collins and Aikman Corp, has joined the Fluorochemicals Division, Chemical Products Group, Minnesota Mining and Manufacturing Co, as technical service representative.

Mr Grajeck will maintain laboratory facilities at Bristol, Pa.

Among the 3M fluorochemical products he will represent is Scotchgard brand stain-repeller.

Holmes

Putnam Chemical Corp, Beacon, NY, has announced the addition to its sales staff of **Harry F Holmes**. Mr Holmes, who will cover the Pennsylvania and Maryland territories, has had many years of experience in the dyestuff field, having served as demonstrator and technical representative for Carbic Color and Chemical Co and more recently as salesman of American Aniline Products.

Samuel Helfand, formerly plant chemist with Stafford Printers at Stafford Springs, Conn, has joined the staff of The Dow Chemical Company's textile development group at Williamsburg, Va.

At Dow's new plant, Helfand, who previously worked for United Merchants and Manufacturers, will be concerned with wet-processing technology for the company's new acrylic alloy fiber, Zefran.

James A Doyle, promotion manager for the *American Dyestuff Reporter* since 1952, has left to become executive secretary of the Catholic Press Association, an organization of approximately 300 publications.

Fantry

Roma Chemical Corp, Newark, NJ, has appointed **John J Fantry** of Rock Hill, SC, as Southern sales representative. He will be in charge of office and warehouse facilities.

Mr Fantry has been associated with resin-bonded pigment and dyeing research as well as the development of plant application techniques for the past eleven years.

TECHNICAL LITERATURE

(Literature is available from sources shown in italics)

ACETO CATALOG—*Aceto Chemical Co, Inc, 40-40 Lawrence St, Flushing 54, NY*———This 4-page catalog, which covers chemicals for the dyestuff, textile and other industries, has been revised to include over 100 organic intermediates which can be supplied in commercial quantities. This catalog lists such organics as methyl acetoacetate, octyl chloride, p-thiocresol, methyl isopropyl ketone and chrysarobin.

ANTISTATIC AGENT 575—*E F Houghton & Co, 303 West Lehigh Ave, Philadelphia, 33, Pa*———This sheet lists the basic characteristics of Antistatic Agent 575, which is claimed to eliminate processing difficulties with fibers due to the presence of static electricity. Also covered briefly are some of the product's uses in textile processing, and some of the conditions and techniques of its application.

ATOMIC SYSTEMS CATALOG A-2—*Baird-Atomic, Inc, 33 University Rd, Cambridge, Mass*———A complete, new line of atomic instrument systems to measure and analyze radioisotopes in industrial, medical and biological applications is described in Catalog A-2.

Four new scintillation spectrometers are described in addition to the instrument assemblies making up the Basic Laboratory and the ultra-precise University Series Laboratory for scintillation, proportional and geiger counting.

BENZOGUANAMINE—*Special Products Dept, Rohm & Haas Co, Washington Sq, Philadelphia 5 Pa*———Technical bulletin SP-142 discusses properties and applications of this product, which is of principal interest as a raw material for resins by reaction with formaldehyde.

It is also reported to have attractive possibilities as a chemical intermediate for application in a number of fields, including dyestuffs.

CDS-129—*Silicone Products Dept, General Electric Co, Waterford, NY*———The major General Electric silicone products and some of the many uses for them are discussed in this new, eight-page catalog.

Among the silicone materials for which data and descriptions are given are resins, water repellents, and antifoam agents.

In addition to basic product and application information, CDS-129 also lists G-E literature providing detailed reports about specific silicones and their applications in the textile, chemical, and other industries.

DUOMEENS—*Armour & Co Chemical Div, 1355 W 31st St, Chicago 9, Ill*———The Duomeens are an alkyl group of trimethylene diamines derived from coco, soya, oleic and tallow fatty acids. They are cationic surface-active agents which will bond strongly to textiles, metal, plastics and other materials.

The booklet covers the chemical and physical properties of the Duomeens and their salts, general reactions and applications. Technical data covering specific gravities of the Duomeens and solubilities will make the booklet valuable to the research chemist.

ELECTRO-CHEMOGRAPH FOR POLAROGRAPH ANALYSIS—*Data Sheet E-94(3), Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa*——— Concise information about the Electro-Chemograph® equipment for polarographic measurements is available in this new 4-page data sheet.

Many convenient features of the Electro-Chemograph are in the new data sheet, including a recorder with a full-scale balancing time of only one second, a built-in standardizing cell, and a newly designed, compact Polarotron® dropping mercury assembly. Illustrations of the equipment and complete specifications are included.

HOW TO CLEAN TEXTILE EQUIPMENT SAFELY—*Harry Miller Corp, 4th & Bristol Sts, Philadelphia 40, Pa*——— This new, two-color, 20-page folder illustrates and describes Immunol, "a nontoxic, nonflammable, odorless solvent and rust preventive for cleaning textile equipment." One part Immunol to 20 parts water is said to be sufficient for all cleaning operations. Cost of the mixture is less than 13¢ per gallon. The product reportedly does not affect textiles and can be removed by plain water rinsing or left in the goods if desired.

Illustrations show application by spraying, wiping, brushing and dipping. A section of the booklet is devoted to 29 salesmen's reports of customer experience with Immunol on textile applications.

IDENTIFICATION OF TEXTILE MATERIALS—*The Textile Institute, 10 Blackfriars St, Manchester 3, England; 80 pages; 123 figures and index; price: 27s 6d, plus postage and packing, which is 3d extra*———One of the most sought-after publications of The Textile Institute is the "Identification of Textile Materials." It is nearly 20 years since the first edition was produced and since then there have been several new editions and many reprints, to meet the demand which has existed over the years for this now-recognized standard work.

A new edition has been produced—the fourth—and it is an indication of the growing complexity of this subject that it is one-third larger than its predecessor. That is the measure of the growing use of new fibers and yarns in the interim period.

The section dealing with Properties of Fibers has been rewritten and considerably enlarged. A feature of these editions is a series of photomicrographs, and two of those of bast and leaf are reproduced in color. The scheme of analysis has also been re-designed so that it is now a more powerful analytical tool for dealing with new fibers and finishes. A special scheme of analysis has been added for use in dealing with fiber blends. A comprehensive section covers notes on reagents and methods of test. The binding, in order to prolong the life of the book, is of water-resistant cloth.

MITIN FF HIGH CONC—*Geigy Dyestuffs, Saw Mill River Rd, Ardsley, NY*———This detailed booklet on Mitin FF High Conc, a mothproofing agent for the protection of wool against damage by moth and derestid beetle larvae, describes the properties and characteristics of the product, and outlines the most convenient and satisfactory methods of applying it.

Section titles include: Properties, Application to pure wool, Application to wool mixtures, Application to pure wool (aftertreatment), Application to bleached and chlorinated wool, Application to wool mixtures (aftertreatment), Effect of auxiliary products, and Determination of the presence of Mitin FF high conc.

ORGANIC CHLORINE COMPOUNDS—*Union Carbide Chemicals Co, 30 East 42nd St, New York 17, NY*———Eleven organic chlorine compounds available in commercial quantities are described in this new, 45-page booklet. The booklet details physical and physiological properties, use information, shipping regulations, handling and storage, and specifications and test methods for the compounds described.

In addition to a detailed description of each compound, there is a general discussion of the advantages of chlorinated solvents, and of handling and storage procedures recommended for chlorinated compounds. Physical properties, physiological properties, shipping data, and specifications and test methods are grouped in tables for rapid reference. Complete instructions for test procedures are given in a 6-page section. There is also a table of constant boiling mixtures, and there are 13 charts of physical properties of various compounds and mixtures.

PERFECT TEXTILE PRINTING TEAM—*M W Jenkins' Sons, Inc, 444 Pompton Ave, Cedar Grove, NJ*——— A short history of textile printing in America and the development of rotary textile printing machinery by Rice Barton Corp of Worcester, Mass is the subject of a recent house organ "Brush Talks" published by M W Jenkins' Sons.

A detailed description of modern techniques in textile printing is included as well as a schematic illustration of a typical printing operation and a schematic of a 4-color textile printing machine.

A photo of one of Rice Barton's High Precision continuous operation printing machines accompanies the text. Jenkins' nylon furnisher brushes used in the equipment are shown in action.

PICK INSTANTANEOUS STEAM INJECTION HOT WATER HEATER—*Water Heater Div, Pick Mfg Co, West Bend, Wis*———This 12-page, illustrated brochure gives complete information on method of operation, specifications, applications, types of installations, engineering data, and a heater capacity table.

Pick water heaters are used in wool scouring, jig-dyeing and most wet-finishing operations in the textile industry.

The brochure cites the elimination of dyehouse overtime through a reduction in water heating time from 15 minutes to one minute in Guyan Mills, Inc, Valley Falls, RI. It was found that only one minute was required to fill a 75-gallon jig with cold water; however, it took 15 minutes waiting to heat the water. After installing a Pick water heater, the waiting time was eliminated due to the instantaneous heating of the water by steam injection as it was drawn for use into the jig.

PREVENTION OF MOTH DAMAGE—*Geigy Dyestuffs, Saw Mill River Rd, Ardsley, NY*———This educational kit has two sections, one containing a suggested talk on the subject of moth damage and prevention, for discussion groups or study programs; the other contains pertinent pamphlets describing the habits of wool-eating insects, such as clothes moths and carpet beetles; advice on how to store clothes and home furnishings to prevent moth damage; and information concerning Mitin "durable mothproofing" compound.

The company also offers to teachers the loan of a 12-min or 26-min version of an award-winning documentary film called "Insects Astray," which may be shown in conjunction with the suggested study program. This film traces the evolution of insects, particularly moths and beetles which were once scavengers, and shows how scientists, after years of experiments during which 80,000 formulas were tested, finally came up with a compound which promises to end insect damage to woolens.

PRODUCT MANUAL ON ADIPIC ACID—*$1.00; R C Molden, Du Pont Polychemicals Dept, Fairfax, Wilmington, 3, Del*———A technical encyclopedia covering the properties, reactions, current uses, and potential applications for this widely used chemical.

Information contained in the manual, it is pointed out, may help manufacturers solve the problem of finding satisfactory new reactants or additives for their products.

SULFUR DIOXIDE—*Ansul Chemical Co, Chemical Products Dept, Marinette, Wis*———A 15-page two-color booklet discusses this chemical at length. It gives information on questions asked most often by manufacturers and research chemists during the 40 years that Ansul has been manufacturing liquid sulfur dioxide.

Included in the subject matter are the physical and chemical properties of sulfur dioxide, specifications and specification test methods, suggested uses, toxicity, shipping and handling procedures.

The publication, one of a series on Ansul industrial chemicals, was designed for use by companies who use sulfur dioxide in their manufacturing processes.

SUMMARY OF SPECIFICATION REQUIREMENTS FOR MILITARY FABRICS (December 1957-revised)— *$4.00; PB 131640, US Dept of Commerce, Office of Technical Services, Washington 25, DC; 137 + viii pages*———Textile Series Report No. 102 has been prepared by the Textile, Clothing and Footwear Division, Quartermaster Research & Development Center, US Army, Natick, Mass.

This report has had a tremendous circulation in the past throughout the textile industry, both when it was issued as Textile Series Report No. 56, issued in August 1949, and again when it came out in revised form as No. 67 in February 1951.

In its present form, which includes twice as many textile fabrics and items as the last edition, it will be more useful to firms in the textile industry which will want to know what the Military Services require that they can produce in their mills or factories.

Specification requirements for military fabrics are summarized in tables which give details for yarn, fabric, and finish. Included are finishing and aftertreatment specifications, and test methods.

Following is part of the foreword by Stephen J Kennedy, chief, Textile, Clothing and Footwear Division, which appears at the beginning of the report:

"Since the issue in 1951 of the previous report, many changes have occurred in textile specifications. In the first place, the Department of Defense has largely completed a conversion of all Army and other Military Department specifications to Military Specifications (MIL) or Federal Specifications (FED). In the process of this conversion, quite substantial changes in specifications of requirements have been made in many cases. For example, Quality Assurance Provisions have been added to the text of many of these specifications.

"Also, the Federal Specifications for testing of textiles, "Textiles, General Specifications Test Methods—CCC-T-191a" has been reissued as "Federal Specification Textile Test Methods—CCC-T-191b". Many changes in test method requirements are reflected in this revision.

"In using his report, it is important to take into account the fact that specification requirements are frequently changed, either by amendment or by the issuance of new revised specifications; also, invitations to bid may include exceptions from the requirements in the printed specification. Requirements stated at the time of actual procurement will, of course, supersede any specification requirements stated herein."

TYPE G-1 AND G-2 MUELLER BRIDGES—*Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa*——— This new six-page Data Sheet E-33(3) lists complete specifications of both instruments and gives typical applications in research laboratories where precise temperature measurements are required, eg, calorimetry, freezing point determinations, etc. A full-page illustration of the Type G-2 is shown as well as interior views of the instrument. The Type G-2 circuit operation is completely described and a schematic diagram is included. The required accessories are listed and the platinum resistance thermometers used with these bridges are described.

General Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
(1958 Gordon Research Conference on Textiles—July 7-11, Colby Jr College, New London, NH)

AMERICAN OIL CHEMISTS SOCIETY
July 14-16 (Short course on soaps and synthetic detergents, Princeton Inn, Princeton, NJ); Oct 20-22 (Sherman Hotel, Chicago); April 20-22, 1959 (Roosevelt Hotel, New Orleans, La; Sept 28-30, 1959 (Statler Hotel, Los Angeles, Calif)

AMERICAN SOCIETY FOR TESTING MATERIALS (COMMITTEE D-13)
Oct 14-17 (Sheraton McAlpin Hotel, New York, N Y)

THE DRYSALTERS CLUB OF NEW ENGLAND
June 20 (Outing—Wachusett Country Club, West Boylston, Mass)

DIVISION OF CLOTHING AND TEXTILES IN EXTENSION, TEACHING AND RESEARCH, UNIVERSITY OF GEORGIA
Nov 7-8 (2nd Textile Seminar, Georgia Center for Countinuing Education, Athens, Ga)

THE FIBER SOCIETY
Sept 9-10 (Montreal, Que)

INTERNATIONAL TEXTILE MACHINERY EXHIBITION
Oct 15-25 (Belle Vue, Manchester, England)

LAUNDRY, DRYCLEANING AND ALLIED TRADES' EXHIBITION
July 17-26 (Olympia, London, England)

NATIONAL COTTON COUNCIL OF AMERICA
Oct 1-2 (Chemical Finishing Conference, Washington, DC)

SOUTHERN TEXTILE EXPOSITION
Oct 6-10 (Greenville, SC)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
Luncheon meetings at the Hotel Roosevelt, New York, NY: Sept 9, Oct 8, Nov 12. Outing: May 26-28, Shawnee Inn, Shawnee, Pa

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